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QUARTERLY

OF THE

National Fire Protection Association

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EDITED BY THE SECRETARY

National Fire Protection Association.

Executive Office, 87 Milk Street, Boston, Mass.

Active Members.

April 1, 1915.

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American Institute of Consulting Engineers.
American Institute of Electrical Engineers.
American Institute of Heating and Ventilating Engineers.
American Institute of Mining Engineers.
American Concrete Institute.
American Gas Institute.
American Electric Railway Association.
American Warehousemen's Association.
Alabama Fire Prevention Society.
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Mississippi Society for the Prevention of Fires.
Missouri Inspection Bureau.
Missouri Fire Prevention Association.
Mutual Fire Prevention Bureau.
National Association of Building Owners and Managers.
National Association of Credit Men.
National Assn. of Electrical Inspectors.
National Association of Insurance Agents, The
National Association of Manufacturers of United States.
National Assn. of Master Gravel and Slag Roofers of America.
National Automatic Sprinkler Association.
National Board of Fire Underwriters.
National Commercial Gas Association.
National Convention of Insurance Commissioners.
Nat onal Electrical Contractors' Association.
National Electric Light Association.
National Founders' Association.
National Hardware Association of U. S., The
National Implement and Vehicle Association.
National Lumber Manufacturers' Association.
National Paint, Oil and Varnish Association.
National Wholesale Druggists' Association.
National Wholesale Grocers' Association.
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Nebraska State Fire Prevention Association.
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New England Bureau of United Inspection.
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New Jersey Schedule Rating Expert's Office
New York Board of Fire Underwriters.
New York Fire Insurance Exchange.
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North Dakota State Fire Prevention Association.
Nova Scotia Board of Fire Underwriters.
Ohio Inspection Bureau.
Ohio State Fire Prevention Association.
Oklahoma Inspection Bureau.
Oklahoma State Fire Prevention Association.
Philadelphia Fire Underwriters' Association.
Philadelphia Suburban Underwriters' Association.
Rocky Mountain Fire Underwriters' Association.
South Carolina State Fire Prevention Association.
South Dakota State Fire Prevention Association.
Southern Cypress Manufacturers' Association.
South Eastern Underwriters' Association.
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Tennessee Fire Prevention Association.
Tennessee Inspection Bureau.
Texas Fire Prevention Association.
The Union.
Underwriters' Associatian of the District of Columbia.
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Underwriters' Association of New York State.
Underwriters' Bureau of Middle and Southern States.
Underwriters' Bureau of New England.
Underwriters' Laboratories, Inc.
Vancouver Island Fire Underwriters' Association.
Virginia Fire Prevention Association.
Western Actuarial Bureau (Fire).
Western Canada Fire Underwriters' Association.
Western Factory Insurance Association.
Western Sprinklered Risk Association.
West Virginia Inspection Bureau.
West Virginia State Fire Prevention Association.
Wisconsin Inspection Bureau.
Wisconsin State Fire Prevention Association.

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Reports on fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

The Evil Wooden Shingle.

The fire originated on the house adjoining the big house shown in the photograph, and was caused by a toy balloon falling on the shingle roof, with the result that this house was almost totally destroyed, and three adjoining houses badly damaged. The fact that the big house was covered with fire-retarding shingles is all that saved it from serious damage, as the side of it was badly burned by the intense heat.

A VOICE FROM THE DEAD!

Another kind of roofing-tile, largely used in pre-Norman times and for some centuries later for certain purposes, was made of thin pieces of split wood, generally oak; these are called shingles.

— *Encyclopædia Britannica.*

The Quarterly

Vol. 8 **April, 1915** **No. 4**

The Nineteenth Annual Meeting. The coming Nineteenth Annual Meeting of the Association is set for May 11th, 12th and 13th, in New York City. A special notice of the date and place was issued by the Secretary on April 1st and the official program will be mailed as usual to members in advance of the meeting.

It is four years since the Association has held its sessions in a hotel. The cordial invitation from the Hotel Astor found favor with the program committee this year and it is believed the members will be well satisfied with the accommodations generously placed at the service of the Association by the officers of the hotel. One of the large banquet halls on the eighth floor is to be used for the sessions. The committee reports this year will be especially interesting, including a revision of the regulations for Automatic Sprinklers; a complete report on Interior Standpipe systems; a complete revision of the regulations for Gravity and Pressure Tanks; a revision of the regulations for Blower Systems; a revision of the regulations for Rotary and Centrifugal Fire Pumps. The Committee on Explosives and Combustibles is to submit revisions of a number of its important standards, including regulations for the storage and use of nitrocellulose motion picture films. The Committee on Fire Resistive Construction is to submit a third section in its present series, and the Committee on Fire Protection Coverings for Window and Door Openings has worked out an entirely new presentment of the regulations on this subject. The Committee on Manufacturing Risks and Special Hazards will present an advisory pamphlet on Cold Storage Warehouses. The Committee on Safety to Life is to take up this year the important subject of fire escapes, upon which a preliminary report was presented last year. Chairman Forster is to use a stereopticon for the adequate presentment of his report. The Committee on Signaling Systems is to bring in a suggested standard for a factory fire alarm system for use in connection with exit drills or factory fires, delivering local signals to the various floors.

The Committee on the Uses of Wood in Building Construction is to make its first report this year, as is also the Committee on Standardization of Pipe and Pipe Fittings. The Committee on Public Information is to report its interesting efforts to secure in the various state legislatures recognition of the principle of personal liability for fires due to carelessness or neglect. Chairman E. V. French of the Committee on Private Fire Supplies from Public Mains is working up a discussion on the subject of the connection of automatic sprinkler systems to high pressure fire service systems.

The tremendous volume of technical work prepared by the committees for the consideration of the Association this year convinced the Program Committee that it was inexpedient to arrange for special individual addresses on any subject. One subject is, however, to be presented by an associate member, Mr. Frank Irving Cooper, Architect, Boston, who for many years has been specializing in schoolhouse construction. Mr. Cooper is to present a brief paper on the character of schoolhouse construction in the United States, illustrating the same with interesting charts and diagrams. This is an exceedingly vital subject to which the Association has not yet given specific attention.

Another feature of especial interest is the round table discussion which the committee has arranged on the practical problems in building regulation. Five minute opening talks are being prepared upon a number of important items upon each of which there is to be a general discussion with each speaker limited to three minutes. Sidney J. Williams, Deputy of the Industrial Commission of the state of Wisconsin, is to preside over this session.

* * * * *

The Building Commissioners and Inspectors. Following our annual meeting at which the problems in building regulation are to be discussed as above noted, the building commissioners and inspectors in our associate membership have planned a special conference at which discussion is to be continued upon items introduced at the N. F. P. A. "round table," and other items, peculiar to the commissioners' and inspectors' calling, are to be considered.

The building inspector usually occupies a unique position in his community. Architects, engineers, the fire chief, the health officer, all come in close contact with certain phases of his work and often throw valuable light on his problems, but they necessarily look at those problems from a different standpoint. The building inspector can, of course, read other building codes, but these are often of little value to the reader who is not familiar with the circumstances of their adoption.

The building inspector must therefore largely work out his own salvation, digging away at the same knotty problems which other officials, a few hundred miles away, are also encountering—which some, perhaps, have measurably solved.

If the building inspector is helped, through information gained at this conference, to render a single decision more accurately, or to advise his city council more wisely, he may save many times the cost of attendance.

Following are some of the questions which the Conference proposes to discuss:—

1. Technical details of fire protection, sanitation, and structural safety, for the protection of both property and life—what protection is ideally desirable, and what can a building code reasonably require?
2. Questions of administration—relation between state and city authorities, methods of field inspection, rigid rules vs. discretionary power, etc.
3. Educational methods which the building inspector can use to gain the support of civic bodies and individuals, and to secure a better understanding by citizens generally regarding fire prevention and sanitation.

This would be a large program for a one-day conference. Fortunately, many of the technical problems will be discussed at the N. F. P. A. meeting, which occupies the three days preceding the building inspectors' conference.

* * * * *

Fire Prevention at the Exposition. There is to be a fire prevention day in the program of the World's Insurance Congress planned for the weeks of October 4th to 16th at the Panama-Pacific Exposition. Tuesday, October 12th, is to be assigned to papers and discussions upon this subject. The N. F. P. A. was invited to co-operate in promoting public interest in this day, and a bulletin to our members was issued in February requesting registration at the executive office of all members intending to visit the exposition who might find it convenient to be present on October 12th. As over seventy-five members responded favorably the N. F. P. A. will be quite adequately represented.

* * * * *

The Fire Chiefs and Fire Prevention. Our active member the International Association of Fire Engineers takes this year a long step on the path of progress which will gratify greatly those who realize what a tremendous potential force for fire prevention resides in the fire department. The strong impulse given the idea of prevention among the fire fighters by the establishment during the past few years of fire prevention bureaus in connection with the fire departments in several of the leading cities has crystallized, in the fire chief's organization, a new and welcome policy. President Hugo R. Delfs has appointed a new committee of the Fire Engineers which is destined to still further revolutionize the psychology of the rank and file of the fire fighters, and give to fire prevention the place in the minds of the firemen generally which heretofore it has held only among the more progressive fire chiefs. No more auspicious beginning for this new Fire Prevention Committee of the Fire Engineers could be devised than that of appointing as its first chairman New York's able and popular fire chief, John Kenlon.

Public Property and Sprinkler Protection. The United States Government has long shown indifference to the matter of protecting federal property against fire, persistently following the old methods of construction having open light wells and other "aids to burning" such as unprotected window openings, etc. Some of the states are, however, beginning to manifest an interest in this matter. The Wisconsin insurance department has, for example, received a report relative to fire hazards at the various state charitable and penal institutions. Structural and other permanent defects are pointed out and radical measures recommended to correct them. The investigations have continued since last August, conducted by C. E. Bennett, fire prevention engineer for the department, together with H. P. Weaver and W. C. West, fire prevention engineers of the Independence Inspection Bureau, and the reports were submitted to Commissioner Ekern.

The most important recommendation made is that of a general sprinkler equipment for nine of the large state properties.

In private stores and factories it is generally recognized that the sprinklers pay for themselves in about five years in the reduced insurance premiums. It is figured that this will be equally true as to the state properties, and that the possibility of a large loss to the state insurance fund on these properties will be practically eliminated by such sprinkler protection.

* * * * *

The Locomotive Spark Hazard. The Indiana Supreme Court has upheld the law enacted last year making a railroad company liable for fire caused by sparks from its engines, regardless of the question of negligence. Previously it was necessary to prove the railroad had been negligent in order to recover damages. This law, while seemingly rather severe upon the railroads, will undoubtedly promote more careful inspection of locomotives. The decision of the supreme court also emphasizes the trend of public opinion toward the justifiability of putting the burden of proof upon the man who has a fire. It was perhaps logical, in view of this decision, that the members of the N. F. P. A. in advocating the Association's "personal liability" bill before the Indiana Legislature this year should have encountered the opposition of the railroad lobby.

The locomotive spark hazard is an ever present one along railroad rights-of-way where bituminous coal is used for fuel, and the railroads themselves suffer continual damage from it. The Rock Island's report for its fiscal year ending June 30, 1914, shows 162 fires on railroad property from locomotive sparks, involving an aggregate loss of $14,276.41. Hot coals caused 35 fires and hot cinders 29. These three items are included in the total of 608 fires from all causes during the year.

Mr. E. B. Berry, chairman of the committee on fire-fighting organization of the Railway Fire Protection Association, furnishes a copy of

the inspection blank regularly used by the Southern Railway. A copy is printed below:—

Engine No..... Round House at..... .....

Arrived..... Inspected..... Depart d.....

Spark Arrester
- Condition on arrival.....
- Repairs made.....
- Condition on departure.....

Ash-Pan
- Condition on arrival.....
- Repairs made.....
- Condition on departure.....

Nozzle .....

..... *Inspector.*

Commenting on this hazard as recognized by the Southern Railway, Mr. Berry says:—

Inspections of engines are made by an employe, whose sole duty is to look after the front ends and ash pans. These inspections are made at the end of each round trip, which average every third day.

Whenever a fire is reported as originating from sparks from our engines, an investigation is made at once as to the condition of the wire mesh arrestor, as well as the condition of the ash pan, and the results checked against the report on file in the Master Mechanic's office.

We have recently equipped all of our engines with dampers both front and back, which are hinged at the bottom and open at the top, precluding the dropping of hot coals unless through carelessness of the fireman or the ash pan becomes choked.

We are making every effort to reduce the number of fires from flying sparks.

There is no doubt that such careful inspection, if regularly made by all the railroads, would reduce materially the many fires from locomotive sparks.

* * * * *

Personal Liability Idea Gains. A suit at law which introduces the principle of responsibility for fire by the owner of property has been instituted at Indianapolis, Ind., by Lauretta Morgan, a tenant, against Edward F. Meyer, owner of a building at 222 East Walnut Street. The plaintiff asks $300 damages by reason of two fires on the premises which she alleges were due to the improper installation of a furnace pipe in a closet. The first fire occurred last September and the second March 8th. The plaintiff declares that by reason of these fires and the inconvenience to her roomers they left her and that furthermore her personal effects were damaged by fire, smoke and water. She accordingly asks the holding of the owner of the property responsible on the theory that the furnace pipe was not properly or safely installed.

The outcome of this suit will be watched with interest as indicating the status of such an action under the common law. The special law advocated at the last session of the Indiana Legislature was defeated in the Senate but gained eight friendly votes in that body. The idea of fixing legal liability for fires due to carelessness or neglect is rapidly gaining favor among thoughtful people throughout the nation. The work of the N. F. P. A. Committee on Public Information has been confined this year to promoting legislation of this sort, as the most effective means of promptly reducing the fire waste.

* * * * *

Field Practice Inspection Manual. The adoption of *Field Practice* by the New York Board of Fire Underwriters as its official inspection manual is but one of the indications of the phenomenal success of this publication which the Association published in December. The entire first edition of three thousand copies was sold immediately, more than half of the number being ordered before the book appeared. It is not unreasonable to hope and expect that this manual will quickly become the national standard guide for the use of fire inspectors throughout the United States and Canada. The two years' work of the committee that compiled the book is most satisfactorily requited by its immediate popularity and recognized usefulness.

The Chapters.

Boston.

Boston Chapter follows her established custom of having monthly meetings either in the form of a noonday luncheon or an evening dinner. At the January luncheon Mr. Gorham Dana delivered a talk on automatic sprinklers. Mr. Dana is a competent authority on this subject and the usefulness of his published book, *Automatic Sprinkler Protection*, is widely recognized.

At the February luncheon Mr. F. A. McInness, Division Engineer of Boston's Water Service Department, described the new high pressure service system now being installed. Boston's high pressure system is to be the last word in modern construction of these services, so arranged that every block will be accessible to two separate and distinct systems of mains.

The quarterly meeting of the Chapter was held on March 31st in the form of a dinner at the Engineers' Club. Mr. Frank Irving Cooper was the speaker and talked on state regulation of planning, construction and fire protection of schoolhouses throughout the United States.

* * * * *

Chicago.

Chicago Chapter is to be congratulated on the success of its campaign to extend the fire limits of that city which has been burning at the rate of an aggregate five or six millions per year. The officers of Chicago Chapter, particularly its President, Mr. Frank D. Chase, have been indefatigable in their work for this fire-limit extension. Strong forces arose in opposition and sufficient power on their part was developed to delay the passage of the ordinance for many months. The final vote on the passage was thirty-nine to six, the opposition being made up of councilmen whose affiliations are pretty well known. The extension of the fire limits adds twenty square miles to the present fire limits and a further extension as provisional fire limits is still under consideration by the council and will be pressed by the Chapter and its affiliated workers.

* * * * *

New York.

New York Chapter had a very successful meeting in February at the rooms of the New York City Club, about two hundred being present.

The talk of the evening was on the subject of the Edison fire, Mr. E. J. Moore of the Turner Construction Company being the speaker. Mr. Moore was Secretary of the Edison Fire Committee of the American Concrete Institute and was well equipped with lantern slides, including a series showing the progress of the fire during the night of December 9th and a series showing the general effects after the fire. The lecture was followed by a very interesting and valuable discussion which was initiated by President Robert D. Kohn.

The annual meeting of the chapter was held on Monday, April 12th, at the City Club. The Hon. Lewis T. Bryant, Commissioner of Labor of the State of New Jersey, spoke on "The Life Hazards in Factories," illustrated.

* * * * *

Pittsburgh.

Pittsburgh Chapter held its annual meeting during the quarter and elected practically a new slate of officers as follows: President, H. H. Robertson; Vice President, F. S. Guthrie; Secretary-Treasurer, John H. Mears; S. A. Dies and John A. Ferguson were the Executives elected for the three year term and W. H. Coster was elected to serve a vacancy in the one year term.

Pittsburgh Chapter intends to make an active membership campaign during 1915.

Members' Activities.

Mr. John R. Freeman of Providence has been appointed special representative of the N. F. P. A. at the International Engineering Congress to be held in San Francisco during the Panama-Pacific Exposition. Mr. Freeman is to present a paper on fire protection at the session on municipal engineering.

* * * * *

Mr. H. S. Wynkoop of New York and Mr. Washington Devereux of Philadelphia have been elected President and Vice President respectively of our active member the National Association of Electrical Inspectors. Mr. W. Lincoln Smith was re-elected Secretary-Treasurer.

* * * * *

President Robert D. Kohn was the N. F. P. A. speaker at the Forest Products Convention held by the lumbermen in Chicago in February. President Kohn analyzed the fire hazard situation as it is related to the general use of lumber in building construction, and dwelt upon the fact that the lumbermen cannot claim the right to be heard in the defense of the use of their product unless such defense is based on a thorough investigation of the subject. The printed reports of the meeting indicate that President Kohn's remarks were favorably received.

* * * * *

Mr. S. W. Inglish, Fire Marshal of Texas, is doing some interesting work in the preparation of short impressive articles on the fire waste for the use of the country newspaper syndicates. This is a service which many of our members might render who can afford the time for it. The publishers of the syndicate "mats" are always seeking brief interesting articles on live subjects.

* * * * *

Mr. F. M. Griswold has during the last quarter prepared a number of articles in aid of the introduction of the national standard hose couplings and hydrant fittings. These articles were designed for special publications and referred directly to conditions in the territories covered by the circulation of the journals in question. The issuance by the Bureau of

Standards, U. S., of the pamphlet on the national standard hose coupling is one of the achievements of Mr. Griswold's indefatigable efforts.

* * * * *

Mr. William Guerin delivered an address before the Flushing, L. I., Good Citizenship League in response to a request of that organization to the New York Chapter, N. F. P. A., to furnish a speaker on Fire Prevention and the Home. Mr. Guerin's speech received a full two column report in the *Flushing Evening Journal.*

* * * * *

Secretary Wentworth delivered addresses during the quarter at the Ohio State University, Columbus, Ohio; the Safety Convention of the State Industrial Commission of Ohio; the National Fire Club of Hartford; the Rotary Club and the Credit Men's Association of Jacksonville, Fla.; the Philadelphia Credit Men's Association; the Rotary Club of Wilmington, Del.; the University of Illinois at Urbana, and the Chicago Fire Insurance Club.

* * * * *

Commissioner Robert Adamson of New York has recently issued two publications of prime importance to fire prevention work in that city. Both relate to the public schools. One is a printed report to Mayor Mitchell giving the results of an investigation into the adequacy of the fire protection of the public schools of the city; the other is a collection of fire prevention lessons for use in teaching fire hazards to the pupils of the schools. In his foreword to the latter Mr. Adamson states that the president of the Board of Education has taken a keen interest in the plan to have this subject taught in the schools. It cannot be denied that most educators in the country are slow to see the virtues of such teaching, presumably because they find it difficult to teach all the subjects already in the curriculum.

* * * * *

The astonishing success of Fire Chief Frank E. Henderson of St. Louis in forming a fire prevention club indicates the awakening of that city to the dangers which the state of Missouri seems to ignore. Over four hundred men and women from all classes have already united in Chief Henderson's Club and will actively co-operate in a number of undertakings already planned. The Missouri Legislature having defeated a fire marshal bill for the state, the St. Louis Fire Prevention Club is discussing the feasibility of creating the office by municipal enactment for St. Louis alone. The club is already planning a program for Independence Day to cut out the usual orgy of fire and noise, and is also making preparations for St. Louis Fire Prevention Day, October 9th. The enthusiasm which the efforts of Chief Henderson have created is exemplified by over two hundred citizens voluntarily offering to act during clean-up

week as clean-up inspectors in the blocks in which they live, and the entire force of the fire department giving up their day off to take part in this work.

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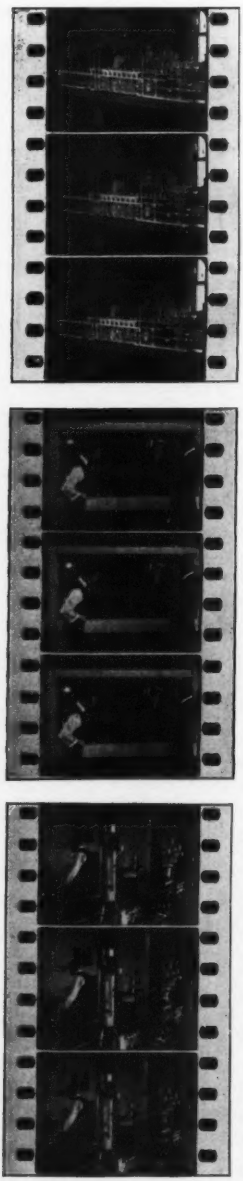
The Rochester Chamber of Commerce, always fertile in fire prevention ideas, is planning, an out-door fire exhibit similar to that conducted by Chicago Chapter N. F. P. A. last October. Demonstrations of fire-fighting devices and other original features will be added.

National Forest Fire Loss in 1914.

The 1914 loss from fire in the national forests of the West reached approximately 340,000,000 board feet of merchantable timber, valued at $307,303, and of reproduction or young growth of trees valued at $192,408, according to statistics just compiled by the Forest Service. There were 6,605 fires, of which only 1,545 burned over an area of ten acres or more. About 77 per cent of all the fires did damage of less than $100 each. In addition to the losses suffered by the Government, timber on State and private lands within the forests totaling 228,008,000 board feet and valued at $175,302 was lost. The total area burned over was 690,240 acres, of which 310,583 acres were State and private lands.

Notwithstanding that it was an exceptionally bad year for fires, on account of high temperatures, heavy winds and prolonged drouth, the average loss per fire was $103, as against $131 in 1911, when there were only about half as many fires. Eighty-five per cent of the total loss was caused by fires in Idaho, Montana, Oregon and Washington, where more than half the timber in all the national forests stands. Less than one-tenth of one per cent of this timber was affected. Of the 6,605 fires reported, 3,691, or 55.9 per cent, occurred in these States and of the ninety-nine fires causing losses of more than $1,000 each, eighty-one were in this region.

Lightning was the chief cause, starting 2,032 fires; campers came next with 1,126, followed closely by railroad locomotives, with 1,110. Incendiaries lighted 470, and the rest were attributed to brush burning, sawmills, etc., or their origin was unknown.



Motion Pictures in Fire Protection.

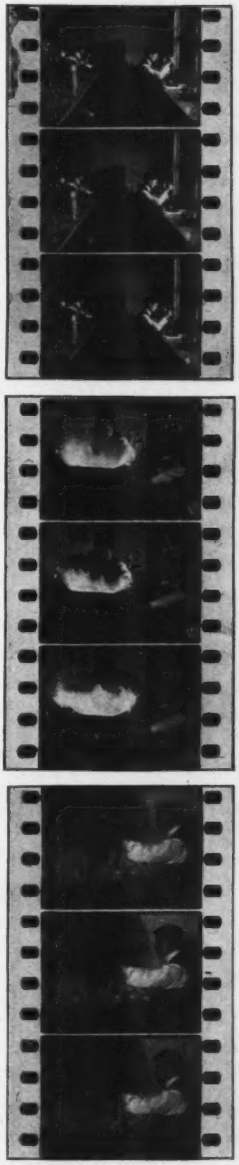
By J. E. Latta (Member N. F. P. A.)

It has been said that the world is always ready to make a beaten path to the door of every man who has something of value to offer in the way of making living more comfortable and life more complete. As a matter of rhetoric such an assertion is immensely pleasing; as a matter of fact, it will not bear even casual scrutiny—certainly not as applying to modern conditions. These days the individual or the institution that has developed something that is worth while must generally undertake to educate the public concerning its value before people can be expected to show great interest in it. This is especially the case in fire protection endeavor.

In effective fire protection, education is fundamental. It is scarcely less important than engineering and scientific investigation. It should be education of the sort that aims ultimately to bring to the attention of all the people, in a convincing way, the real significance of our fire loss; education that undertakes the widest possible promulgation of information concerning means that are found efficient in combatting this enormous waste. This is something more than publicity, as that term is commonly used. It is publicity of the intensive kind—the sort of thing that will count against the indifference to the fire waste that seems so lamentably characteristic of the American public. The writer is convinced that any worker in the fight against fire who has not caught the spirit of this sort of publicity is falling short of a proper appreciation of his duties, and his opportunities.

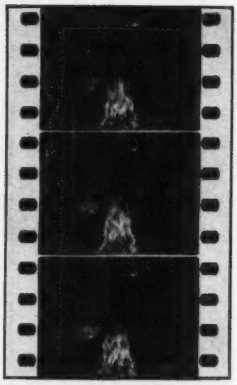
The foregoing is sufficient explanation—if, indeed, any explanation at all is needed—for the following brief account of what appears to be in the nature of an entirely new departure in fire protection publicity.

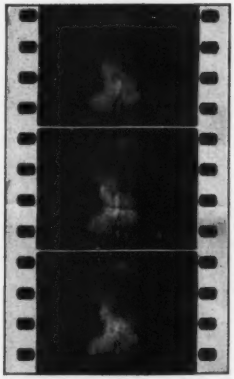
Most readers of the QUARTERLY have some notion, at least, of the work of the Underwriters' Laboratories. Many of them are aware, in a general way, that the Laboratories endeavor to secure the best and fairest opinion regarding the merits of every device, appliance and product in respect to fire and life hazard. They are more or less familiar, too, with the Laboratories' methods of promulgating the findings of its engineers and councils. Moreover, most readers who attend the annual sessions of the National Fire Protection Association have seen something of the actual operation of the main testing station at Chicago. Underwriters' Laboratories is always desirous of having the public in general and fire protection interests in particular know intimately of its work. Hence, people seeking information concerning the institution are always welcome visitors. But occasional visits are not sufficient of themselves to do more than impart a rather general impression of the make-up of the plant, and perhaps provide some specific information concerning such tests as happen to be under way at the time of the visit. And it is to be remembered that the people who have an opportunity to visit the Laboratories are but a small fraction of the public that the institution is serving. Hence, at the request of friends of the Laboratories, there has been prepared a series of motion pictures, illustrating in an instructive and impressive way, the investigations and tests that are carried on at the Chicago plant, and these will be available for use in educational work in the fight against fire and accident. The pictures aim to provide the man unable to visit the institution with important information concerning this service. At the same time they will afford those who do occasionally come data more detailed and comprehensive than usually can be acquired by even frequent visits.

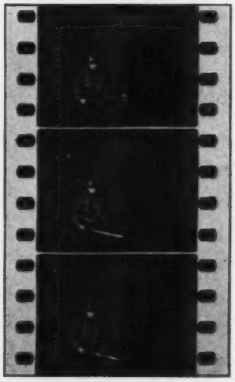


The "Movies."

The "movies" carry the observer into practically every department of the Chicago testing station, and show him, wherever he goes, charac-







teristic tests in process of performance. The following brief summary indicates the general character of the films; but the reader should bear in mind that it is not here attempted even to catalogue or enumerate the collection with any considerable degree of completeness. The few cuts shown with this article were selected more or less at random from the collection.

One of the pictures provides an unusually good view of the building of Underwriters' Laboratories at Chicago, which is conceded to be the best example in America of an absolutely fireproof structure, furnished throughout with fireproof equipment.

Subsequent views show various sections of the Chemical Laboratories, where different members of the Laboratories' staff of chemists are seen busy with the tests and experimental work that make up the usual routine of their daily duties.

Here are chemists at work making analyses of such materials as the rubber linings of fire hose, the insulating compounds used on rubber-covered wires, sweeping compounds, roofing materials, electric conduits, hazardous fluids, paints, etc.

Chemical hoods of the latest and best type, provided with powerful electric-motor driven fans, carry away fumes and vapors, and keep the air pure and free from all substances whose presence might prove detrimental to the comfort and health of the men making these analyses.

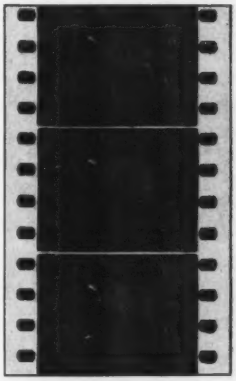
In what is known as the optical room, experts are seen using the microscope, the spectroscope and the polariscope for refined tests on the materials of certain kinds of fire-protection equipment.

Another engineer is seen operating a machine designed for making determinations of the strength and stretch of rubber compounds.

In the physico-chemical section of the chemical laboratories electric furnaces are in operation, the pyrometer being employed to measure the high temperatures attained in these; a spontaneous combustion test on a sweeping compound is under way, and likewise a flashing-point test of a hazardous liquid. Tests of friction matches are

going on, and the operation of vapor-explosion test apparatus is shown.

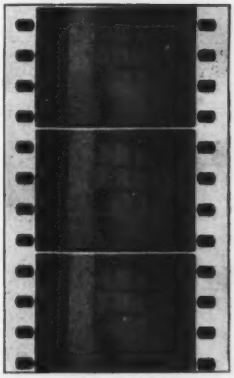
Views in the Chemical Laboratories include also some of the more interesting parts of the equipment of the weights and measures laboratory, and of the special tests rooms.



Electrical Department.

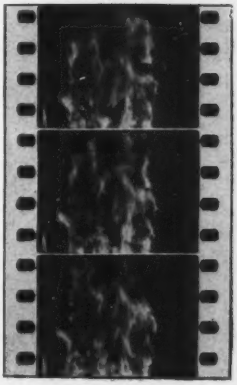
Passing on to the Electrical Laboratories, one sees a large machine for testing snap switches and sockets in operation. This piece of apparatus is entirely automatic in its operation, and is arranged to turn on and off any type of switch or socket now on the market.

Another test of particular interest which is seen here is that applied to flexible tubing, which is used, of course, to protect the conductors in interior electric wiring.



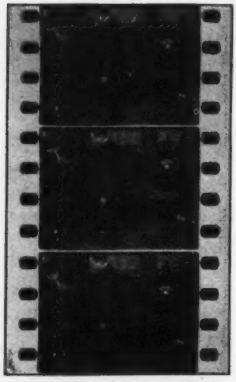
Flexible tubing manufacture is one of the one hundred industries in which Underwriters' Laboratories' Label Service is operated. The tubing is regularly inspected by the Laboratories' engigineers at the factories, and such of it as is found to be standard is labeled. Check tests are made at Chicago from samples sent in by the inspectors at the factories. The motion pictures cover heat tests on the exterior coating, moisture tests, and examination for fireproof quality, tensile strength, etc.

The Laboratories' tests on rubber-covered wire are covered rather completely. Engineers are seen making the measurements prescribed in the National Electrical Code, preparing samples for the voltage breakdown and wrapping tests, and performing such of these and other tests as can be shown in an instructive manner.



Standard tests on cartridge-enclosed fuses are shown in a way that is interesting and instructive, and a somewhat spectacular demonstration of the fire hazard of improper or inadequate fusing is one that is bound to prove impressive to persons concerned with fire and accident protection.

As the pictures move along, still other illus-



trations of the work and equipment of the electrical department of the Laboratories pass and make plain the hazard of improper construction in numerous household and other electrical appliances, and indicate the proper means of safeguarding against hazards of this sort.

Protection Department.

A division of the Laboratories' work that appears always to be of particular interest to every visitor to the Chicago plant are the investigations conducted in connection with fire doors, fire windows, automatic sprinklers and similar protective appliances, equipment and materials. In the pictures the observer is given an opportunity to see just how problems of this character are taken care of.

For example, as relates to fire doors and fire windows: Complete standard tests are conducted, and the pictures are made to include every detail that it is possible for a camera in the hands of an expert operator to catch. The methods of exposure to high temperatures are made clear; also the processes of measuring the temperatures and the heat transmission, and of determining the effects of high temperature exposure on the appliance itself, and the effects of heat radiated to flammable articles on the unexposed side; and so on throughout the tests.

Automatic sprinkler testing is covered scarcely less completely. These illustrations include sprinkler equipment installed under conditions similar to those of actual service; this equipment exposed to fire; and views emphasizing the effectiveness of automatic sprinklers in extinguishing fires.

Gases and Oils Department.

The illustrations of the work of this department comprise numerous tests on hand fire appliances and on devices, materials and apparatus which, though hazardous in character, may be safeguarded in an acceptable manner. Than some of these there are probably no tests conducted in

the Laboratories that are more interesting; certainly few more interesting to the layman.

Disposal of the Pictures.

The pictures will be kept on file at the office of the Secretary of the National Fire Protection Association, to be used by him and such other persons as he may care to have use them; and at the Stubbs Lecture Bureau in Chicago. The writer will also carry a set of pictures with him on his trips over the country as special agent of the Laboratories, and will show them to gatherings of people interested, whenever it is desired and convenient.

Secretary Wentworth's publicity work in fire protection campaigns needs no commendation here. Mr. Lurton H. Stubbs, who will use the pictures for the Stubbs Lecture Bureau, is splendidly qualified for such work. He has had fifteen years' experience as a fire insurance man, during much of which time he has specialized on fire prevention service in his relations with his customers. He is a natural entertainer, with a cheery manner which puts him on friendly relations with his audiences. He has been making fire prevention addresses for several years, and has come to be regarded by those who know him as one of the most effective speakers in the work.

It is planned to add to the collection of pictures from time to time, as additions are made to the Laboratories' equipment. There will soon be included a machine of special and unique design for testing columns, beams, girders, etc. Engineers will be seen conducting tests on built-up steel columns, reinforced concrete columns, and practically every other material of this class employed in modern building practice, the material under test being subjected to the conditions of an actual fire or conflagration while the engineers study its behavior. In short, it is intended to make the pictures provide continuously as complete a representation of the current operations of the Laboratories as an up-to-date "Movie" review can properly show.

Collapsed Floors from Overloading.

Although there was not any fire in this building, the lesson to be drawn is a good one. The building was of ordinary brick construction with wooden floors and timbers. The entire five floors were occupied by a dealer in raw leather who carried a very large stock at the time. The upper floors were piled high with heavy cases filled with leather, while the second floor contained rolls of leather, as shown in the photograph.

One night, without the slightest warning, the three upper floors gave way and allowed their entire contents to crash through to the second floor. That this floor did not also collapse was probably due to two reasons: (1) a general forward movement of the mass as it fell, which caused the material to jam against the front walls; and (2) the cushioning effect produced by the rolls of leather which took up the shock. Fortunately no one was in the building at the time, but had the collapse taken place during the day, many people would probably have been killed or injured.

There are many buildings like this one, in which the floors are loaded far beyond the safe value for which they were designed. The occupants change and a much heavier stock is brought in without considering the effect on the floors. However, should a fire occur, there is almost certain to be a complete collapse of all the floors either from a slight weakening of the supporting beams or the extra weight produced by the water used in extinguishing the fire. Suppose this building had been on fire, the firemen working in the lower floors and tons of water being poured into the upper floors to extinguish the fire,—what would have been the result?

Seattle Invites Her Fate.

In the QUARTERLY for July attention was called to the mischievous action of the Seattle City Council in repealing the regulation requiring that fuel oil should be stored 200 feet from tide water in steel tanks enclosed in water-tight bulkheads of a capacity one third larger than each tank in order that rupturing of the same would not spread oil upon the water of Seattle Harbor. The amendment, which was protested against by the fire chief, the fire marshal and numerous fire protection engineers, allowed the storage of barges at dolphins in the bay, practically opening the entire water area to the traffic in oil. While most other cities of the seaboard were devising ways and means to protect their water fronts from such a hazard, Seattle deliberately at the behest of certain interests jeopardizes all her large shipbuilding and other industries along the water front and exposes the entire city with its shingle roofs to destruction by conflagration. It was protested by the fire department officials of Seattle at the time this reactionary step was taken by the Council that, should oil tankers be stored in the harbor as contemplated, in the event of fire therein fire might communicate to half the water front before tugs could successfully haul such a tanker from her berth. It was also pointed out that in the event of a tanker being run into in a fog such an accident would result in a spread of oil all over the harbor. As if the words of the fire marshal were prophetic, this is precisely what happened on Thursday, February 18th, when a vessel rammed an oil ship in a fog. From about 8.30 a. m. to nearly 2 in the afternoon a heavy stream of fuel oil poured out of the injured tanker upon the water, most of it going outward with the tide and coming back on the turn about 1 o'clock. At the head of the little slips and coves around the big shipbuilding plant next south, the oil appeared as a solid mass two inches thick along the shore with a heavy scum alongside the outer ends of the wharves. Most of the fill under the Seattle Construction and Dry Dock Company, commonly known as Morans, is slab and rubbish,—all made ground of that character. All this was coated and soaked with oil. The oil gradually reached the piling and fills all around the harbor, the extreme range of the tide being about fifteen feet. The owners of the tanker reported that oil from one compartment only escaped but the hole was near the bow and the tanker sank by the stern. She was full of oil and holds 10,000 barrels. Some of the contents was pumped out and saved; it is not reported how much. Floating piles and timbers were thickly coated with oil. At one point half a mile from the injured tanker and under one of Seattle's largest wooden docks, oil thickly covered the water. A pile

driver engineer half a mile away reported that when sparks from the stack struck the water that afternoon little flashes were noted from the film of oil. It is extremely fortunate that no pile driver nor steamboat fireman happened to throw overboard any live coals. Such a proceeding might easily have started a general water front conflagration. The Municipal League of Seattle reports that it is not unlikely that the oil will be carried by the tide to the municipal bathing beach at Alki Point and render that resort too greasy for pleasure during the summer. We present a diagram

Elliott Bay: Seattle's water front. The dotted lines enclose the greatest hazards. Piers (not shown) project into the water-space enclosed. Locations of land oil tanks and sunken oil barge shown; also recent dock fires.

of Elliott Bay herewith, showing the location of the rammed tanker and the location also of the dock fire of July 30, 1914, and that of January 16, 1915. In both these fires the flames got to the piling under the platforms. The argument of the General Petroleum Company used before the City Council was that the result of permission to permanently moor an oil barge in the harbor would cheapen the cost of oil. With a big shipbuilding plant next door and costly wharves all around, the tanker which met the accident was a constant menace at all times.

The most interesting fact about this accident which menaced the safety of the entire city was that not a single Seattle newspaper said a word as to the floating oil hazard or assisted in any way in warning the ship masters to be careful until the floating oil in the harbor might be dissipated. *The Seattle Times*, the principal afternoon newspaper, had only this to say after reciting the details of the collision without reference to the hazard involved:—

"Officials of the General Petroleum Company, in discussing the accident, said it furnishes a complete answer to the fight made last year against the granting of a permit to allow the corporation to moor an oil barge in the harbor. At that time, they say, opponents of the permit argued that in the event of a collision the oil barge would probably be blown to pieces and adjacent shipping endangered. The accident to-day, they declare, shows there is no danger of an explosion in such a mishap."

The obvious manner in which the officials of the General Petroleum Company evaded the real point in the original protest against their menace of the public safety is most interesting. No one, so far as we are aware, made any reference to the danger of an explosion. The hazard emphasized was exactly that which was illustrated by the collision on February 18th. Will the authorities of Seattle having responsibility for her protection be warned by this demonstration and put an end to the vicious practice which is now allowed, or will the need for reasonable precautions be made apparent only by a square mile of blackened ruins?

The Fire Hazard of Firecrackers.

By Walter L. Wedger (Member N. F. P. A.)

Chemist Massachusetts District Police.

I have carefully examined a large number of samples of firecracker at the laboratory, of both Chinese and American manufacture, which were submitted by Boston dealers.

In the Chinese product the explosive consists of potassium nitrate or saltpetre, sulphur and charcoal, corresponding to our black gunpowder. One end of the paper tube has a plug of hardened red clay, while a fuse made of tissue paper twisted around a core of black gunpowder, projects from the other end.

The flame accompanying the explosion of the gunpowder is very small and of extremely short duration, but the paper of which the tube is composed has the property of igniting very easily from this flame and continues in a state of smouldering combustion like a slowmatch, until consumed, during which it is possible to cause it to burst into flame by exposure to the wind.

It will readily be seen that it is this peculiar property of the paper tube which creates the fire hazard when such firecrackers are exploded in congested sections, the wind blowing the flaming fragments against combustible construction, or into doors and windows which are likely to be open at such seasons of the year, and fire follows.

Examination and analysis of the tube shows it to be composed of a soft paper made of very fine vegetable fibres, lightly calendered and dyed in different colors. Sheets of it are rolled in tubular form and covered with red tissue paper. I find the paper of the tube to be unevenly impregnated with tartaric acid and potassium nitrate, the former probably coming from the composition of the dye, and the latter, owing to its easily soluble nature, coming from the explosive by contact therewith.

This accounts for the continuity of smouldering fire in the tube and to correct this and render the paper incapable of ignition, if this same Chinese paper is passed through a weak solution of ammonium phosphate in water, in the proportion of from four to eight ounces to the gallon, all danger of the paper retaining fire is removed, and with such removal, in my opinion, at least ninety per cent of the fire hazard from the use of these articles is eliminated.

The additional cost entailed by this chemical treatment of the paper

would be extremely slight, and in no way comparable to the annual fire loss directly traceable to these articles.

In the manufacture of some kinds of matches, the wood splints are now chemically treated to render them non-glowing, and decorations of cotton, paper and other fabrics are likewise treated to prevent inflammability.

American-made firecrackers are more expensive than the Chinese product and cannot be enjoyed so universally. They are composed of tubes made from sheets of straw paper which is incapable of continuing in a state of glowing combustion, even if ignited by the fire of the explosion, which rarely occurs. The explosive consists of potassium chlorate, sulphur and carbonaceous material. The danger of impregnation of the paper by the explosive is very remote owing to the nearly insoluble nature of the potassium chlorate, and the insolubility of the other ingredients.

I exploded samples of both kinds experimentally and in no case did the paper fragments of the tube ignite from the fire of the explosion of the American product, while ignition of the tube fragments of the Chinese product occurred in almost every instance.

The Boastful Hoppergrass.

Br'er Hoppergrass he 'low, he did,
"Ef hoppin' times you'd see,
I bet you that no kangaroo
Kin hop as high as me"!
An' he wuz hoppin' ten foot high
W'en Mister Mockin' bird come by.

Den Mister Mockin' bird, he riz
An' sing out f'um de tree:
"I wuz lookin' fer my br'akfas'
W'en my br'akfas' comes ter me!"
Br'er Hoppergrass—his day gone by;
De trouble wuz, he hop too high!

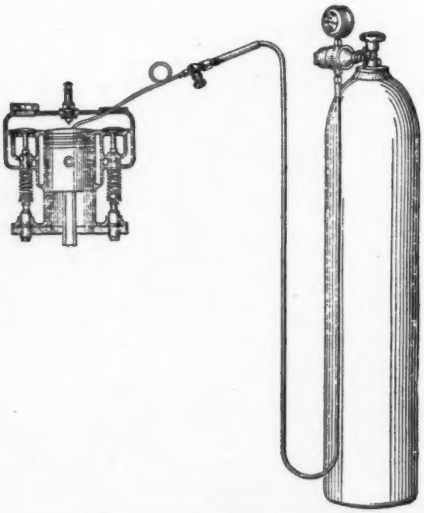
—*Atlanta Constitution.*

Decarbonizing Cylinders of Automobile Motors.

By Chas. H. Fischer (Member N. F. P. A.)

Engineer Schedule Rating Expert's Office, Newark, N. J.

The examination of the combustion chambers of the motor of an automobile which has been driven for say 1000 miles will show that the combustion chambers contain carbon deposits and incrustation. These are formed as the result of imperfect combustion of the engine fuel and the burning of any surplus amount of lubricating oil fed to the cylinders. A careful analysis of such incrustation will often show that it contains some silicates, which are drawn into the combustion chambers through the carburetor. The amount of such deposit and incrustation formed in the combustion chambers depends somewhat upon the grade of fuel and lubricating oil used, but more upon the amount which is used. Too rich an explosive mixture and too much cylinder oil will greatly increase the rate at which the deposit is formed. The presence of an excessive amount of deposit will manifest itself in noisy operation, overheating of the engine, pre-



Decarbonizing Apparatus.

ignition, and loss of power, due to reduction of compression on account of deposit getting under the exhaust valve.

Previously, such deposits and incrustation were removed by a long, tedious and expensive process of scraping, the thoroughness of which depended largely on the patience of the mechanic. During the past few years two methods have been devised for removing this carbon, both of which are very simple, and involve little labor.

By one method the carbon is burnt out with the aid of a jet of oxygen, and by the other method the carbon is loosened by the use of denatured alcohol, methyl acetone used alone or in combination with other substances similar to paint removers, and then drawn off suspended in the liquid.

From the fire hazard standpoint the process incorporating the use of oxygen is the more important. The apparatus required for this process consists of a tank of oxygen, a reducing valve (for reducing the tank pressure of 1800 lbs. to the operating pressure of 15 to 25 pounds), two pressure gauges (one for the tank side and one for the jet side of the reducing valve), 12 to 15 feet of rubber tubing, about 18 inches of ⅛-inch copper tubing to insert into the combustion chambers and a small cock for controlling the jet.

The different steps in the process, as suggested in whole or in part by some of the manufacturers of the numerous oxygen decarbonizing machines, and approved by this office, are as follows:

Take the automobile outside of the building. Start the engine and then close the valve in gasoline supply pipe at the tank, allowing the engine to draw all the gasoline from the carburetor, when it will stop; be sure the drip pan is clean; place wet bagging over the carburetor; remove one spark plug, or, better still, one valve cap; place the piston of the cylinder to be cleaned on the compression stroke; if any surplus lubricating oil is on the top of the piston remove with oil gun; drop a lighted match or lighted wax taper into the combustion chamber and direct a stream of oxygen on the flame, which will ignite the carbon deposit; gradually move the jet of oxygen to all parts of the combustion chamber, thus consuming all of the carbon. This process of burning will be accompanied by a small shower of sparks coming out in the atmosphere and falling on the motor casing.

The process as described by some of the operators and as actually carried out by others is quite different from that recommended above. Some operators will close the valve in the gasoline supply pipe and remove the gasoline from the carburetor, but fail to use wet bagging over the carburetor. Practically all operators overlook cleaning the drip pan. Some operators will remove two spark plugs or two valve caps, and others only one. However, this is not so important. The removal of any surplus lubricating oil is generally omitted, which causes a flame, sometimes two or three feet long, to shoot out of the opening when the oxygen is supplied. The piston is always placed on the compression stroke. One or more matches are generally used to start the carbon. Frequently a little kerosene oil or gasoline is poured into the combustion chamber to facilitate the burning. This, too, when the oxygen jet is inserted will cause a long

flame to shoot out of the cylinder opening, or in the case of gasoline might cause an explosion. The amount of sparks which are emitted and the length of the flame will depend largely on the use of the controlling valve at the jet. Some operators pay little or no attention to this, which results in rather larger showers of sparks and long flames. In some instances no pressure regulator is employed, a plain globe valve being placed at the tank; this, of course, provides no regulation, is very unreliable, and permits of no control at the jet.

There are two reasons for this short-cut, careless method of doing this work. First, the execution of this work by careless, inexperienced mechanics, ignorant of the possible results of hazardous methods. Second, when this process was first used, the charge for doing such work in the public garage was $1.50 per cylinder, and, in some cases, as high as $2. As the use of the process became more common, competition forced the charge down to $1 per cylinder, and, in some instances, as low as 50 cents per cylinder. This, naturally, means that less time and cheaper labor must be used for this particular work, which results in an increased hazard.

If the process is carried out as recommended, it is probably no more hazardous than any spark-emitting device in a garage. The operation, however, as actually performed in practice, frequently by inexperienced and careless help, is, without doubt, considerably more hazardous, as it may be with a leaky carburetor full of gasoline, or an oil pan full of oil, and with some gasoline exposed to long flames and large showers of sparks, some of which find their way to the carburetor and oil pan.

Motion Picture Film Hazards.

The problem of properly meeting the hazards of storing and handling nitro-cellulose motion picture films grows more perplexing with the increasing popularity of the motion picture. The high inflammability of the common film has since the invention of motion photography been a matter of growing concern with public officials charged with conserving the common safety and with underwriters endeavoring to estimate the probable hazards of the special conditions in which nitro-cellulose films appear. The presence of motion picture film exchanges in buildings containing other occupancies is now very generally frowned upon throughout the country. Very little success, however, has followed the attempts that have been made to banish the film exchange to the outskirts of the cities, in which location such a hazardous business properly belongs. More success has been attained in locating film exchanges in fireproof buildings of which the exchange is the sole occupant. The expeditious handling and exchange of picture films seems to require that the exchange should be located in the congested value districts of cities where their hazards to both life and property are greatest. Given such a location, it is obviously the duty of public authorities to safeguard the process of storage and handling as far as possible. The Committee on Explosives and Combustibles of the N. F. P. A. attempting to revise the present regulations for the storage and handling of nitro-cellulose motion picture films, is confronted by the growth in the size of these exchanges since the last publication of the regulations in 1910. At that date it was deemed a reasonable requirement that the number of reels of films in a room under examination and repair at any one time should be limited to ten. The present feeling of the Committee is that this requirement is practically impossible to enforce, and it is to be recommended to the Association that this number be increased to twenty and that additional safeguards be thrown about the industry in the form of certain restrictions as to the rooms in which the processes are carried on, the disposition of scrap, waste, cement, etc.

The storage problem has also grown in significance. It is obvious that owing to the character of nitro-cellulose, vaults, safes and cabinets containing motion picture films should be properly vented to the outer air by an adequate pressure relief useful in case of fire. Just what proportion the cross-section of such pressure-vent should bear to the size of the storage vault no one in the absence of proper experience or demonstration can tell. Realizing this difficulty the Committee, with the assistance of the New York Fire Department and the film manufacturers, has been carrying on a

series of tests in New York City during the past month. The results of these tests will be indicated by the character of the final recommendation made by the Committee on the item of vents, notes upon which were withheld from the advance printing of the Committee's report to the forthcoming annual meeting. In addition to the hazard of storing and handling these films inside buildings is the ever present hazard of motion picture films in transportation. The motion picture business, having grown to such enormous proportions, trains, street cars, omnibuses, boats and all other public carriers and passengers therein are constantly exposed to this hazard by messengers carrying films for exchanges. A fitting illustration of this hazard, coupled with an example of the characteristic carelessness and recklessness of the American people where fire is concerned, is illustrated by the following report of a fire in a railway coach, details of which have been kindly furnished by Chief Inspector B. W. Dunn of the Bureau of Explosives.

Col. Dunn's Report.

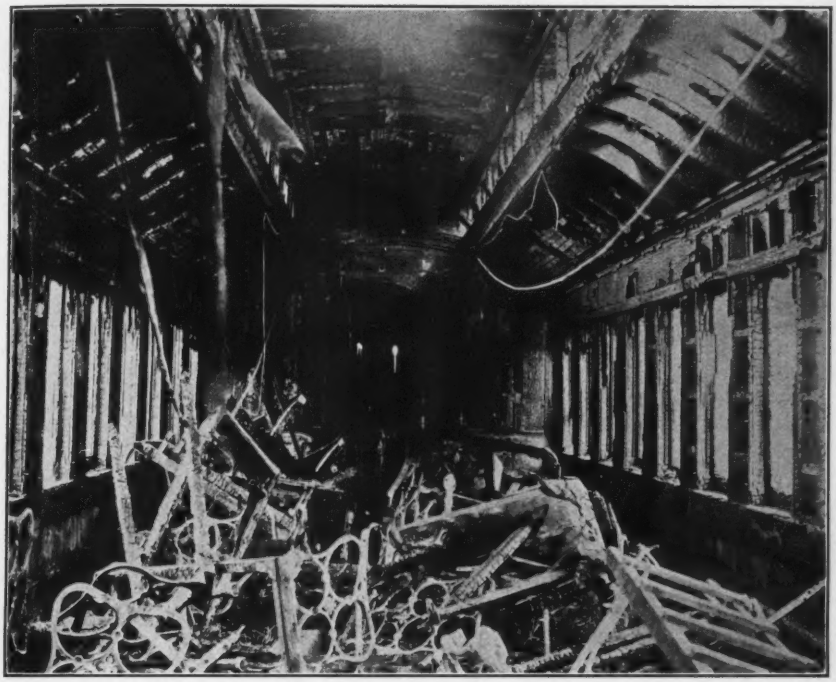
On the evening of November 24, 1914, a passenger on a surburban train running out of Chicago, carried into the combination smoking and baggage car a paper-wrapped package containing four reels of moving picture films which he had secured from a film company in Chicago for use in an exhibition at a surburban club. This film company did not prevent this highly inflammable product, in criminally careless packing, leaving its premises, although its representative must have had intimate knowledge of the danger and must have been familiar with the safe packing prescribed by the Federal regulations. The film company saved a few cents; the public paid with valuable lives.

The package was placed on the floor of the car between two seats near the center of the car, and about four minutes after the train had left its Chicago terminal a puff of smoke arose from the package, which was instantly followed by a burst of flames. Passengers in front of the flames rushed for the door of the baggage compartment, and, in opening it, let in a draught that caused a rapid spread of the fire. The train was stopped, but before the passengers could get out of the car 38 persons were badly burned. Two have died as a result of the injuries and one is not expected to live. The damage to railway equipment amounted to $2,465.00.

The person who took the films into the car was taken to a hospital suffering from burns, but was discharged the following day.

The films were evidently ignited by a lighted match, cigar, or cigarette. They were not properly packed as required by the Federal regulations for express shipments. Their protection was a paper wrapping which facilitated ignition and served only to conceal the contents of the package.

This unfortunate accident emphasizes a serious menace to life in a widely prevalent practice. It has been estimated that more than seven thousand messengers are kept traveling over the railroad to circulate the films that are not sent by express. Some progress has been made, for express shipments, in bringing the security of packing up to the standard set by the Federal regulations. When a defective package is offered the express company it is subject to inspection and rejection. The railways, however, cannot prevent the inclusion of dangerous articles in hand or checked baggage. Granting that a passenger is willing to risk detection, one effect, therefore, of safeguarding express shipments may well be to increase the number of dangerous packages in passenger cars. The elevated, street and subway cars in cities are subject to this hazard and probably to a degree that is appreciated only by those whose interests require rapid circulation of these films.



Result of Nitro-cellulose Film Fire in Smoking Car.

The composition of the base of these films differs only slightly from that of smokeless powder. Unless strongly confined there is no danger of a violent explosion, but the fire hazard is a sufficiently serious menace to life.

It should be realized by the large and small dealers in moving picture films that the education necessary to make effective any law or regulation for the safe transportation of this product, can be and should be accomplished by them. There would be no chance for a repetition of this accident if the dealers would see to it that no reel of moving picture film is allowed to leave any of their establishments without being packed strictly in accordance with the following regulation prescribed by the Interstate Commerce Commission and now effective for shipments by express:—

> "(43a.) Moving picture films must be packed in tightly closed metal cases inclosed in a strong, spark-proof wooden box; or in spark-proof cases made of sheet iron not less than 0.02 inch thick (No. 25 U. S. standard gauge) and lined throughout with fiber board at least ⅛ inch thick, or some equivalent insulating material. The covers of these cases must fit tightly and must lap over the body at least ⅝ inch on the sides, forming a tight joint."

Even when packed as above, a highly inflammable article of this kind should not be carried into a passenger car when this can be avoided. The danger in a smoking car is evident and in ordinary cars the careless placing of packages in

contact with steam pipes or radiators may in rare cases cause spontaneous ignition of films that have deteriorated chemically. The present baggage regulations of many of the railways prohibit the carriage of these films in either hand or checked baggage. Sections 235 and 236 of the Act of March 4, 1909, entitled "An act to promote the safe transportation in interstate commerce of explosives and other dangerous articles and to provide penalties for its violation" reads as follows:—

> "SECTION 235. Every package containing explosives or other dangerous articles when presented to a common carrier for shipment shall have plainly marked on the outside thereof the contents thereof; and it shall be unlawful for any person to deliver, or cause to be delivered, to any common carrier engaged in interstate or foreign commerce by land or water, for interstate or foreign transportation, or to carry upon any vessel or vehicle engaged in interstate or foreign transportation, any explosive, or other dangerous article, under any false or deceptive marking, description, invoice, shipping order, or other declaration, or without informing the agent of such carrier of the true character thereof, at or before the time such delivery or carriage is made. Whoever shall knowingly violate, or cause to be violated, any provision of this section, or of the three sections last preceding, or any regulation made by the Interstate Commerce Commission in pursuance thereof, shall be fined not more than two thousand dollars, or imprisoned not more than eighteen months, or both.
>
> SECTION 236. When the death or bodily injury of any person is caused by the explosion of any article named in the four sections last preceding, while the same is being placed upon any vessel or vehicle to be transported in violation thereof, or while the same is being so transported, or while the same is being removed from such vessel or vehicle, the person knowingly placing, or aiding or permiting the placing, of such articles upon any such vessel or vehicle, to be so transported, shall be imprisoned not more than ten years."

Moving picture films are classed as one of the "other dangerous articles"; they must be packed for transportation in accordance with paragraph 43 quoted above; each package must be marked to show plainly the contents: "Moving Picture Films"; each express or baggage package must also bear the standard yellow label carrying the shipper's certificate: "This is to certify that the above articles are properly described by name and are packed and marked and are in proper condition for transportation according to the regulations prescribed by the Interstate Commerce Commission."

These packages must be transported by freight or by express on those railway lines that prohibit their transportation as baggage. Where transportation as baggage is permitted, the packages must be offered for checking, or carried as hand baggage, as specified in the rules of the individual carrier, without any attempt at concealment and without avoiding in any way the requirements of the regulations. In addition, intelligent care must be exercised during transit to protect the packages from lights, fires, contact with steam pipes and other sources of heat.

The British Fire Prevention Committee has been giving its attention to this hazard and certain members of the Committee visited Germany before the outbreak of the war to ascertain the effectiveness of public control of the nitro-cellulose-using industries in Berlin and Leipzig. Nitrocellulose passes in England and continental countries under the name of "celluloid" which in America is the copyrighted name for a special product. A film producer's establishment conducted on a large scale in Berlin was found located on the top floors of adjoining buildings of the warehouse class. The processes of the concern included the taking of photographs and scenes in a large studio and the whole process of

developing, drying, tinting, manipulating, repairing, boxing, etc., together with storage on a large scale. The members report that the requirement that *not more than three films* should lie open in any one place during manipulation or repairs seemed to be closely observed. In Leipzig a film renter's store was visited and was found on the lower floor of a tenement building. The regulations did not appear to be fully observed and the package and storage of films for transit were exceptionally bad.

A circular letter issued to the various English authorities by the British Home Secretary indicates that in England also the precautions taken have not been all they should be. Emphasis is placed in the report on the fact that nitro-cellulose is subject to decomposition at comparatively low temperatures "when it emits inflammable gases and when well ignited great jets of flame are shot out, causing greater risk to adjacent buildings than an ordinary fire." One of the New York papers published a fake photograph of the Edison fire, showing white streaks across the plate, purporting to be streaks of fire caused by the sailing of motion picture reels through the air. It is reported, however, that during the fire in the film storage house of the Lubin Company at Philadelphia last June this phenomenon actually occurred. The circular letter of the British Home Secretary recommends the storage of all "celluloid" goods on the top floor of buildings. It urges the prohibition of the use of sealing wax on parcels containing celluloid articles, and cites the fact that the dropping of burning wax on celluloid was responsible for the disaster which occurred in Moor Lane, London, in 1912, which caused the loss of nine lives. It is further recommended that packages containing celluloid articles should not be soldered without a protective plate between the soldering process and the celluloid, several serious fires having been reported from Paris, due to careless methods of soldering. The report also states that motion picture films are sometimes festooned in shop windows. It is doubtful if American carelessness has reached this limit.

It is now perfectly well known that motion picture films can be satisfactorily produced by the use of acetate of cellulose which makes a slow-burning compound. The processes of making films of this character are not at present monopolized by any one producer. It would greatly simplify one of the greatest modern problems of fire prevention if the nitro-cellulose film, its manufacture and use were to be prohibited at once by law. While it is understood that the first attempts at producing the slow-burning film were not wholly successful in obtaining a product with satisfactory wearing properties, these faults, according to reputable manufacturers, have now been overcome and practically the only reason for the continuance of the manufacture of the "gun-powder" film is that it is a penny or two cheaper than the safe film. The problem so often encountered in the work of the N. F. P. A. is repeated in this instance. The dollar is weighed in the balance against the public safety and the public safety suffers and endures it, experts in protection using all their ingenuity to safeguard the possible results of a hazard which should not exist. No movement in this country has yet been attempted to prohibit the use of the inflammable film. In France, however,

a definite step has been taken and the use of the inflammable film is to be forbidden by law after July 1, 1915. Following is the order issued by the Prefect of Police for the City of Paris, which is serving as a model for similar requirements in other French centres. We are indebted to the *Red Book* of the British Fire Prevention Committee for a copy of a free translation of these regulations, which are as follows:—

Order of Paris Prefect of Police prohibiting the use of nitro-cellulose motion picture films after July 1, 1915.

We, the Prefect of Police,

Considering that the use of cinematograph films of celluloid is a source of serious danger with respect to fire, and that it is actually possible to substitute in their place films which do not easily ignite, called "safety films" (de securité);

Considering, on the other hand, that it is equitable to allow owners of cinematograph establishments a sufficient interval to enable them to obtain safety films;

At the proposal of the Secretary General,

We order the following:—

Article 1.

The use of cinematograph films of celluloid or any other easily inflammable material is forbidden in establishments to which the public is admitted.

Article 2.

An interval, which will end on 1st July, 1915, is accorded to owners of cinematograph establishments to enable them to conform with the regulation.

There is no alteration with regard to the precautionary measures with respect to cinematographs to be found in title VII, chapter I, of the Regulation of 10th August, 1908.

Article 3.

This regulation will be printed, published and posted up in Paris and the parishes under the jurisdiction of the Prefecture of Police.

The following are instructed to see that this regulation is complied with, each in his own sphere:—

In Paris, the Director of the Municipal Police, the Commissioners of Police, the Police Officers and others in authority in the Prefecture of Police;

And in the towns and parishes of the Seine Department and the Seine-et-Oise Department under our jurisdiction, the Mayors, Commissioners of Police and all public authorities;

The Colonel of the Republican Guard, the Colonel of the Seine Police (gendarmerie), and the Colonel in command of the Fire Brigade are required to assist in its execution.

For the Prefect of Police:
The Secretary General,
E. Laurent.

The Prefect of Police:
Hennion.
Paris: 13th November, 1913.

It will be observed that these requirements are dated November, 1913, a year and a half being given in which the inflammable films might be worn out or discarded. Undoubtedly such an extension of time is just, owing to the value of the films. Should the cities of the United States undertake a similar prohibition, undoubtedly a time limit would be set.

In the hope that the use of the slow-burning film might be encouraged by devising some plan by which it might receive special consideration through the modification of the general protective requirements now enforced by municipal and other authorities, representatives of the manufacturers of the slow-burning films were invited to meet certain members of the N. F. P. A. last month in New York for discussion of the matter. The manufacturers of the slow-burning films justly feel that the hard conditions imposed upon the nitro-cellulose product should not be imposed upon the slow-burning films in manufacture, storage, exchange, handling, or exhibition. The difficulty encountered is that at any time a reel of the nitro-cellulose film might be introduced and exhibited with all its hazards in any place normally set aside for the sole use of the slow-burning film. While certain of the non-inflammable film manufacturers are indifferent to the competition of the nitro-cellulose film makers, owing to the use of the former material in special projection lanterns, others are keen that there should be nothing in the manufacture of the slow-burning film to interfere with its use wherever the nitro-cellulose reels are used. Picture houses which would like to use the slow-burning film only and thus secure privileges from the authorities as to protection, size of the audience room, etc., are not willing to be disqualified from using the nitro-cellulose reels upon which frequently appear the most desirable and attractive subjects. It was the thought of the members of the N. F. P. A. meeting the manufacturers of slow-burning films in this conference that it might be possible for the manufacturers of the slow-burning films to treat their product either through special perforation or by the provision of some mechanical safeguard so that their reels could be used in the machines using the nitro-cellulose film, but that the nitro-cellulose film might not be used in the machines provided for the use of the slow-burning film. It is obvious that the manufacturers of the slow-burning product will have to unite and work out a solution of the problem along these or similar lines if they are to receive the concessions they desire from the constituted authorities. It must be definitely and positively demonstrated that the use of a nitro-cellulose film cannot be introduced where safeguards have been dispensed with in recognition of the harmless character of the slow-burning film.

The members of the Association attending the conference which discussed this matter were: Chairman F. J. T. Stewart of the Executive Committee, Secretary Franklin H. Wentworth, Manager W. H. Merrill of the Laboratories, Chief J. O. Hammitt of the Fire Prevention Bureau, New York City, Col. B. W. Dunn of the Bureau of Explosives and H. W. Forster, Chairman Committee on Safety to Life. The gentlemen representing the slow-burning film industry were: Mr. F. W. Lovejoy of the Kodak Co., Mr. L. H. Wallace of the Raw Film Supply Co., Mr. W. B. Cook of the Pathescope Co. of America, Mr. Franc of the American Cellone Co., Mr. Malitz of the Pathe Freres, Mr. Scull of the Thos. A. Edison, Inc., and Mr. Jno. Nicholaus of the Committee of Film Users.

As a result of the conference the manufacturers agreed to confer and work out a plan if possible under which the authorities might be warranted

in suspending, where the use of the slow-burning film can be definitely depended upon, the restrictions drawn to cover the "gun-powder" film.

British House of Commons Inquiry.

An interesting foreign note on the two classes of film, their relative cost and their unrestricted production is furnished by the minutes of evidence of the British House of Commons in a hearing last May on a "celluloid" bill, introduced by the Glasgow Corporation.

Mr. Chas. Richard Henning, representing the Bayer Company, Ltd., of Germany, was sworn and testified in part as follows:—

QUESTION: Do you think also that it would be to the advantage of the trade that a safety film should be used because of the extension of business which cannot be undertaken at the present moment?

ANSWER: I think so very much, because the cinematograph industry is probably only in its infancy. You can apply the moving picture to teaching in schools at various places, whereas now it would be practically impossible to use it on account of the danger which would result for the audience. There is still a tremendous development possible in the cinematograph industry. You can use it in the home for entertaining, whereas now it is used on a small scale which can be very much extended.

Q.: These exhibitions in Berlin, for instance, would be forbidden by the police if they were used in private houses?

A.: I understand so. That is not possible.

Q.: Or in schools?

A.: Quite so.

Q.: Well then, as to the question of price?

A.: There is practically no difference on that point, in my opinion, between a safety film and a celluloid film. There may be something in favor, probably, of a safety film. It depends on the cost of the raw material to be used. To-day nitric aceto might be more expensive; to-morrow acetic aceto might be cheaper. These conditions fluctuate very much. There may be, for instance, the demand for acetic aceto. If there was a bigger demand the manufacture would be increased, and it would become cheaper in future than what nitric aceto is to-day. I believe that acetic aceto might be manufactured quite as cheaply in years to come as nitric aceto is to-day, because if the demand is extended for raw material there is generally keener competition and larger manufacture going on, and consequently cheaper production. Therefore the safety film might be just as cheap or cheaper to produce than the celluloid film.

Q.: At the present moment which is cheaper?

A.: At the present moment the cheaper production is probably the celluloid film.

Q.: The nitro-cellulose film?

A.: Yes.

Q.: Is the difference very great?

A.: No, I do not think there is much difference in it.

Q.: Could you give the Committee any idea what it is, say per metre?

A.: Our own company would supply a safety film at quite the same cost as a celluloid film. There is no difference therefore, for practical purposes, although the cost of production is probably larger than in the case of a celluloid film. But there is sufficient profit to allow for that difference.

Q.: Then the safety film could be supplied in quite sufficient quantity?

A.: Practically in any quantity according to what is required. Probably a big demand would spring up within a week and it could not be supplied, but given time

there would be sufficient manufacture going on and there are sufficient manufactories to supply the wants.

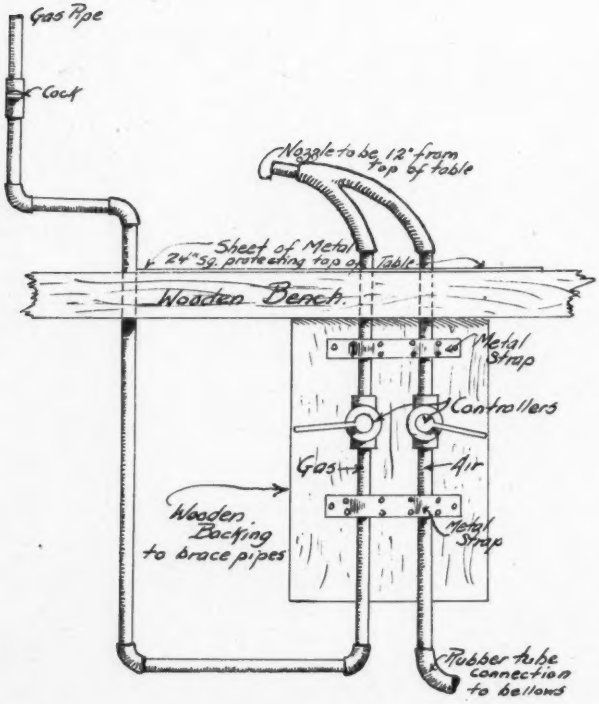
Q.: There is no question arises about the cornering of the market, for instance?

A.: To my knowledge there are about half a dozen manufacturers in the country, and they are all fairly large firms who would meet any demand arising.

To Eliminate Fire-Traps.

"Fire-trap Hotel" is the name the *Chicago News* says ought to be employed to describe certain lodging houses in the United States. That designation would protect persons from danger, and the Chicago paper urges municipalities to shift the burden of fire responsibility to the shoulders of lodging house and cheap hotel proprietors by enacting proper ordinances and seeing that they are enforced. Until that is done municipal authorities are directly responsible for the loss of life. In the event of failure to obey the law promptly, the violator should have the odium of "fire-trap" placed in front of his place. — *North Carolina News Bulletin.*

Blower Torch Installation.



Suggested Safeguarded Blower Torch Installation.

Sketch by W. D. Owens (Member N. F. P. A.)

Storing and Handling Stock on Skids.

By John M. Colby (Member N. F. P. A.)

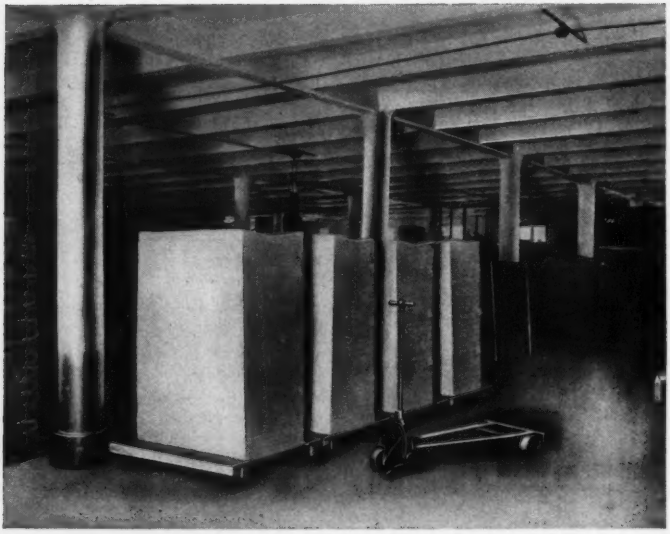
Inspector Underwriters Bureau of New England.

Some new stock handling trucks have recently been placed on the market, the platforms of which can be elevated or lowered as desired.

Where these trucks are used it is necessary that the stock be kept on special skids so constructed that the truck can be backed under them. The platform is then elevated and the skid with the stock can be wheeled to the place desired. The skids are about eight to ten inches high and generally consist of a platform nailed to two pieces of plank or timber on edge, the space between the uprights being slightly wider than the truck. They can be bought ready made or made by any local carpenter.

The trucks are built of iron and have either three or four wheels. The platform consists of an iron frame which is, in its lowest position, six or more inches above the floor, when the handle by which the truck is drawn is in an upright position. When a pile of stock is to be moved, the truck is backed under the skid between the upright supports. The handle is then dropped, which by means of connecting levers and cams elevates the platform an inch or two, thus lifting the skid and stock clear of the floor. The platform is locked in its high position and will not drop until released by a foot lever or other similar device.

The manner in which the stock is stored on the skids depends upon the nature of the stock and the ingenuity of the user. It may be placed on a rack with shelves, hung on pegs or hooks attached to an upright surface or piled directly on the flat platform. Three tons of stock can be handled in one load. This method of stock storage is of great importance from a fire protection standpoint, as it is necessary to keep the stock on these skids at all times which permits quick handling, insures drainage in case the stock has become wet, and protects it from water standing on the floor. Stock has generally been stored unskidded, but where the old method of skidding was used, consisting principally of piling stock across two pieces of joist placed parallel to each other on the floor, the results were unsatisfactory. It only raised the stock a few inches, and unless fairly rigid the edges of the piles were apt to sag until they rested on the floor. Small stock could not be as readily skidded as with the new device.



Skids and Truck.

The skids needed for the use of these trucks are at least six inches high and have a platform bottom, as it is necessary to have a clear space slightly higher than the truck in order to back it under the skid. These skids may be used for stock in process, whereas with the fixed skids it was customary to skid only raw stock in storage. On these skids the stock will be in piles more or less disconnected and ready to be quickly transferred to another location if necessary.

Advantages in Using this Method of Storage.

1. Stock may be placed on the skids on arrival at the factory and stay there until required for use. It can then be quickly sent to any part of the factory without rehandling.

2. One man with one truck can do as much work as several men by the old method.

3. Less capital invested in trucks.

4. It would greatly assist in keeping the factory in a neat and orderly condition.

5. In case of fire, sprinkler leakage, or any other emergency, stock can be removed from any location in a short time.

6. A great reduction in damage due to water on the floor at time of fire or from any other cause. Also wet stock will drain, thus reducing loss.

The Fire Hazard in Turbo-Generators*

By G. S. Lawler (Member N. F. P. A.)

Engineer Factory Mutual Fire Insurance Companies.

The chances of electric generators of the older types being seriously injured by fire in the event of some part of the insulation failing is slight. Occasionally arcing will ignite the insulation at some point, but it is seldom that the fire will spread much before it is extinguished. This freedom from fire damage is due principally to the comparatively low speeds, the accessibility of the combustible insulation, and the fact that the machines being of large mass per unit capacity, the insulation is considerably distributed.

This condition of practical freedom from fire is reversed in the case of generators of the turbo type, for when a short circuit occurs in one of them there is a great chance that the insulation will be ignited and the machine be badly damaged; in fact such damage has occurred in a number of instances.

The chief causes of the increased hazard inthe more modern type generators are as follows:—

(*a*) The volume occupied by this type of machine is very much less for the same capacity than that of the older types of generators, so that the combustible insulation is more concentrated and, therefore, much of it is exposed, even to a slight arc or fire. The covering on the conductors depends greatly for its insulating qualities on the presence of oils or gums of a highly combustible nature. The amount of this combustible insulation on the higher voltage generators is naturally greater than in the low voltage machines.

Owing to turbo-generators having only a few poles the end connections between slots form a large proportion of the total length of conductors, in fact in some designs approximately one half of the coils are outside of the slots. These end connections, one half being on one side of the machine and one half on the other, are exposed to fire, and as with a pile of loosely laid sticks, fire will rapidly extend from the insulation on one coil to that on the others.

(*b*) Owing to these generators being of exceedingly large capacity in many instances (one of 30,000 kva. capacity now being constructed) an enormous amount of energy is involved in a short circuit, especially at the instant the short occurs and as the arc is confined in the limited space with the combustible insulation, it would seem impossible for the insulation to escape being set on fire at many points simultaneously.

*Paper read at meeting of The American Society of Mechanical Engineers.

(*c*) The machines are cooled by forcing large quantities of air through the spaces between the conductors. The large and constantly renewed supply of oxygen will hasten combustion when it is once started.

The air is given somewhat of a rotary motion by the rapidly revolving rotor which has the ventilating vanes on it and consequently fire when started will be quickly swept around the exposed insulation.

(*d*) The generators are totally encased with the exception of the air inlets and outlets and even these in some designs are under the machines. This construction prevents access to a fire and much valuable time will necessarily be consumed before extinguishing agents can be used effectively. When the field current is cut off, as is necessary in case of short circuit, the only means of bringing the rotor quickly to rest is lost and it will continue to run for a long time after the steam has been shut off. Some machines will run for over an hour. This continued rotation is not conducive to the quick extinguishing of fire, especially when the ventilating vanes are mounted on the rotor.

In addition to the possible causes of arcing existing in the case of the older types of generators, the turbo-generator is subject to momentary large current rush at instant of short circuit, even if the short is external to the machine itself, unless means are taken to keep the current within safe limits. The heavy rush of current causes mechanical stresses in the conductors, which in some cases are severe enough to distort the conductors, especially where outside the slots, and to injure the insulating covering, resulting in a short circuit within the generator itself. In some designs the internal reactance of the machines will permit of the momentary current rush amounting to 40, or possibly more, times the normal full-load current of the machines.

The possibility of the conductors being distorted has been reduced in some cases by designing generators with sufficient internal reactance, or by providing external reactance such that the current at the moment of short circuit will not be great enough to damage the generators. Attention has also been given to supporting the stator end connections to prevent their distortion. These means have undoubtedly greatly increased the safety of the turbo-type of generator from possibilities of internal short circuit, but in no way tend to prevent a fire resulting should an arc occur.

A short circuit in the rotor will probably not result in a severe fire unless under exceptional conditions. This is also true if the short circuit occurs inside of a stator slot. A short circuit involving a stator coil, however, is more apt to occur at the end of the slot where the conductors are exposed.

As asbestos is now used largely for insulating the rotor windings and as these windings are well protected, it is probable that only in cases

of severe fire in a machine will the rotor windings be damaged to any extent.

While the generators may be free from fires during the earlier portions of their life owing to the proper use of reactances which prevent external troubles seriously affecting the machines, as they get older the ordinary causes of breakdown of insulation are liable to occur and fires result. Probably in most cases generators will not be discarded until some trouble, usually in the nature of a short circuit, has occurred at least once in each, so that it is reasonable to expect that unless further preventive means are taken, turbo-generators stand a good chance of serious damage by fire at some time during their life. Although many fires have occurred, probably most of them have happened during the generator development stage. Generators of the turbo type are of such recent production that none of them has yet reached a life which could be considered old and, therefore, the troubles which can be expected near the end of their life by fire have still to come.

Undoubtedly the manufacturing companies have given serious thought to the matter of the reduction of the fire hazard in turbo-generators and have employed all means practical at the present time to this end, but there is still very much to be desired. The following several means if taken together would seem to minimize the chances of a serious fire:—

(*a*) If a suitable material could be found, a non-combustible outer covering could be placed over the insulation on the stator end connections. This would greatly delay the spread of fire and even if no other protective means were taken, would undoubtedly prevent much serious damage. Where fire extinguishers were used the covering would at least hold back the fire until they could be brought into play. At present no material suitable for such a covering appears to be available.

(*b*) If a non-combustible outer covering should be put on, its advantages would be partially lost in time unless the cooling air were freed of the dirt and oily vapor liable to be in it. This could be done by filtering, as has already been advocated several times.

(*c*) Means could be provided for cutting off the air supply in case of fire in generators by placing dampers in the inlet ducts designed so as to be normally held open by fusible links. The links could be placed so that they would be quickly fused by the heat and allow the dampers to close automatically. By reducing the oxygen supply to that entering by leakage the action of the fire would be slow.

(*d*) Arrangements could be provided for the quick introduction of carbon dioxide gas into the machines. The carbon dioxide could be kept in liquid form and piped through valves, expansion tanks, etc., to the generators. The valves could be arranged to be opened by the closing of the air inlet dampers so that the gas would be automatically introduced into the generators. This gas would be very effective in extinguishing fires inside the machines after the air supply had been cut off.

The employment of some efficient method of reducing the fire hazard in generators of the turbo type either along the lines mentioned or in some other way is important. The value of these generators is great and the damage by fire may amount to a considerable proportion of the first cost. It is probable that the damage is more liable to occur toward the end of the life of the generators, but even then the loss may be large, both directly and indirectly. The large central stations have reserve units so that the increased damage due to fire in one of their generators would probably not affect the continuity of service, but the increased time necessary for repairs may be long and during this time the reserve capacity will be weakened. In the case of industrial plants the longer time needed for repairs might be serious. Many manufacturing concerns who generate their own current depend on only one unit and, therefore, their whole production, or a large part of it, would be affected.

Steam Laundries.

By Kenneth W. Faunce (Member N. F. P. A.).

Inspector Underwriters' Bureau of New England,

"Laundry" is a general term applying to many different kinds of washing and ironing establishments, and representing various types of construction and processes. Most every home has a room which is used as a laundry at times, and hotels, clubs, etc., have a room set aside for laundry purposes. These are mostly hand laundries where the washing and ironing is done by hand. Another type is the commercial laundry, commonly known as the steam laundry because the motive power was originally entirely steam. This article will be confined to this type.

In the modern laundry steam is a factor of great importance, it being used more and more for all processes, and the steam boiler hazard is one that should be well considered. A laundry with a cut off or detached brick boiler house and a well-protected flue is the ideal arrangement, but it is a sad truth that this ideal is but infrequently reached. Boilers installed in the basement of some old frame building with metal flues running within a few inches of unprotected woodwork are conditions too often found. These are, however, gradually getting to be conditions of the past, for lately more consideration is given to the construction of laundry buildings and the installation of the boilers.

Processes.

The processes of a steam laundry are essentially the same in one as in another. The difference in the construction and arrangement of the building may make the relative locations of operations a little different, and a point to be considered in this connection, from a fire protection standpoint, is to arrange the occupancy so as to eliminate the necessity of the ever undesirable floor openings, such as small chutes between floors.

Washing.

The first process, washing, is not at all hazardous. The washing machine is usually of wood, and consists of two large cylinders, one of which is inside the other. The inside cylinder, which is perforated, revolves, and is the one in which the wash is placed. The outer one is stationary, and is provided with water, steam and drain pipes. The washing fluid, consisting of hot water, chip soap and "washing soda," is introduced into the outside cylinder, reaching the clothes through the perforations

in the inner cylinder. After the machinery is started, the washing process is carried on for about forty-five minutes. The washing water is drawn off and the clothes are bleached and rinsed. A "bleaching powder" composed of calcium hypochlorite and chlorinated lime or soda is used for bleaching purposes.

The only hazards incident to this process are those of ordinary machinery, such as hot bearings, oily waste, etc.

After the goods leave the washing machine they are either wrung out or dried in a centrifugal drier, in which condition they are known as "rough dry."

Starching.

The next process is starching. Formerly all starch was heated before being used, and the hazards were those of the heating apparatus. Most of the starch cookers are now steam heated, with an occasional gas stove used for this purpose. Recently, however, a new process for starching shirts has been developed which utilizes cold starch; in this process the goods are ironed wet. This is at the same time a saving of starch, and a reduction in the already light hazards of the starching process.

Drying.

The drying process is the most hazardous of all. Of course the time allowance and space available prohibit the ordinary air drying such as is used in the home, so the heated dry room is resorted to. To obtain rapid and effective drying it is essential that the temperature in the dry room shall be kept fairly constant and high (from 180 to 200 degrees Fahr.). The method of supplying heat in the modern laundry is by means of steam pipes, but occasionally one will find a coal stove or other similarly antiquated method in use. Fans are used to circulate the air and to remove the large quantities of moisture in order to maintain a dry heat throughout the dry room.

Drying is accomplished by leaving the goods in the dry room for a certain length of time, depending on the temperature. The "rough dry" goods are hung on movable metal racks, which are either fastened to the door or are entirely separate, and when the drying is completed, the racks are removed from the drier and the clothes from the racks. Other driers known as conveyor driers are used for small work. These consist of a constantly moving endless chain of metal conveyor hangers on which the clothes are hung. The clothes pass into the dry room on these hangers, and after about forty-five minutes come out again completely dried. The goods are dropped automatically from the conveyor into a box when dried, and as the dried pieces are released, wet ones are attached to the hangers by an operator, and the conveyer continues its round through the drier, taking about forty-five minutes to make one complete round.

It may be seen that in steam driers it is of vital importance to arrange the steam pipes so that no clothes can accidentally fall and come in contact with them. If the pipes are on the floor they should be shielded with

a heavy wire net, stretched across and over the pipes, this arrangement will prevent the clothes from coming in contact with the heated pipes should any of them drop from hangers or racks. In rooms where the steam pipes are on the sides, the danger of contact with them is not so great, and for this reason they are frequently left exposed. The ideal arrangement would be to have these also protected with a heavy wire net in order to obviate all danger.

In some establishments considerable thought has been given to a model arrangement of the dry room, and in some plants it is very well equipped while in others it becomes a decided hazard to the rest of the plant. Nothing need be said about the protection of all-metal dry rooms, but the protection for wooden ones might be mentioned. The most effective protection for the wood is double lock-jointed tin with a layer of asbestos or other non-conductor between the tin and the wood.

Ironing.

Ironing is done both by hand and by power. Some people insist that their shirts, etc., shall be ironed by hand, and this together with the fact that some small pieces have to be hand-ironed makes the presence of gas or electric-heated hand irons necessary. The hazards incident to the use of these are well known and are generally the result of careless use. Irons left on a combustible ironing board have been the cause of innumerable fires. A precautionary measure for obviating this hazard, in the case of gas irons, is to close the main gas valve at the meter when leaving the iron for any length of time, and in the case of electric irons to provide the safeguards prescribed by the National Electrical Code. Metal stands for the irons should of course be used, and these kept free of combustible material.

Flexible Tubing.

The use of flexible tubing for hand irons is general, and forms a distinct hazard in itself. Tubing is more or less subject to injury and breakage, which may be the cause of fire by the ignition of escaping gas from a broken tube. Reinforced flexible tubing or all metal flexible tubing is made and used extensively for this purpose. Because of these hazards the use of unnecessary lengths of flexible tubing for machines where much of it might be replaced by fixed metal piping, should not be tolerated. Many proprietors have come to realize the dangers of flexible tubing by bitter experience, and as a result have replaced long lengths of it with permanent metal piping, using the flexible tubing only in the short length necessary for the swing of the iron.

Power irons are made for practically every variety of work. The flat-work ironer is the largest, and consists of a number of metal cylinders, usually gas or steam heated, which are wrapped with a covering of felt or linen or muslin. The scorching and burning of these wrappings is a hazard to be considered, and watchfulness and frequent changing of the

coverings is necessary, with also care as to the gas flames to keep them from igniting inflammable material. The smaller power irons and presses differ only in size from the flat-work ironer, and present the same hazards.

Conclusion.

It is gratifying to find that the tendencies in modern laundry construction are toward making the steam laundry a safer property from a fire protection standpoint. New first-class buildings are replacing the old worn out ones, and the more general use of steam has reduced the former hazards considerably.

Smoking on Farms.

Time was when smoking in the country was infrequent, but in these days of high prices and automobiles thousands of farmers enjoy pipes and cigars and their help use cigarettes. In the olden days there was little danger from fires on this account, but there is danger to-day. The owner of a farm would not think of lighting his pipe in the barn, but his hands will. Farmers should watch their help so as to guard against carelessness with fire. Farmers should carry insurance, but they should see to it that buildings are not burned. In very few cases does the policy really cover the actual loss to the insured.

Volunteer Fire Departments.

By Harry W. Bringhurst (Member N. F. P. A.).

Fire Marshal, City of Seattle.

To write upon this subject without giving much space to the workings of the large volunteer departments at present in service in the Atlantic Coast states, would not do at all if my paper were to be anything of a history; but it is not. In a way, those great systems are institutions; they are the result of years of development and each may be said to have its own methods and customs. Men starting a new department could learn a great deal from them and might even see some things to avoid. Undoubtedly some one will criticise me for not simply telling how they do it in one of those cities and then coming to a conclusion, but my object is to write of volunteer systems in a general way and to make only such recommendations as may be useful in the West as well as in the East.

To do this with a proper degree of thoroughness, one should commence at the beginning of things; at the time after a fire in some unprotected town, when the citizens have been given a serious fright. Doubtless all the members of the community over the age of ten or so have exhausted themselves climbing upon roofs, working the neighborhood pumps or passing buckets of water. One or more buildings are smouldering ruins and only a favorable wind has saved the business part of the town. Into the minds of the citizens come visions of bright vermilion paint and glistening nickel plate. The talk is all of waterworks, engines and hose, and what other towns have for fire protection. It is argued that something must be done and done at once, else insurance rates will go clear out of sight and the whole town may be fire swept at any time.

But there may be twenty different ideas proposed as to what to do and how to do it. Just what really happens, if the excitement does not cool off in a few days, may depend upon the persuasive powers of the first apparatus agent who comes to town. Most probably the City Fathers are entirely without experience in such matters and have no competent and disinterested person to advise them. The result may be the purchase of something entirely unsuitable. At least half our towns can show one or more pieces of unwisely bought fire apparatus standing around, representing good money and taking up valuable space.

Preliminary Organization.

If the proposition of public fire protection is considered with a view to real efficiency, and the most practical return for the expense, the first

step is to organize a fire department, with careful study of how it is to operate; the second to secure and distribute an adequate water supply, and the third to provide means of utilizing that supply in such hose streams as will afford reasonable protection. In practice, the first can be accomplished without delay, while for financial or other reasons, it may prove a long time before the others are commenced, much less brought to completion. Many towns are fortunate enough to have at hand rivers or other bodies of water for engine service, and these afford at least a partial solution to problem second. The kind of fire department to be organized depends largely upon the appliances and apparatus it is to use, but to get down to first principles, the procedure at the start will be about the same in any case. We may presume that a volunteer system is the only one possible.

A public meeting is usually called for the purpose of organizing a fire company. There are likely to be speeches on the crying need for fire protection and the glory of being a fireman; then a number of men sign a roll and proceed to the election of a Chief and other officers. This is the time-honored custom that has doubtless been followed ever since the insurance companies paid the firemen, but it may be all right or all wrong. There is likely to be failure and disappointment if the matter is not taken up in the proper spirit and if the Chief and other fire-fighting officers are not chosen with efficiency alone in view. Even calling the former a Chief "Engineer" will not make the department a success unless that individual has the right stuff in him. So the meeting should be in a sense "packed" with the substantial professional, business and working men of the place and they should take a lively interest. It is advisable to have the roll a large one in order to secure and try out a goodly number and develop the active firemen needed. It might be said that many of the best volunteer companies have been those of large membership, with a considerable proportion of men who are more for influence and support than for work. There is much difference of opinion on this point, due no doubt to experiences under diverse conditions. However, a large number at the start is desirable, if only because many will lose interest and drop out. Efforts to elect permanent officers should be diverted into discussions of ways and means, and an adjournment taken for several days.

One general rule is good for all fire departments, large and small, paid and volunteer. This is that under ordinary circumstances the character of the department depends upon the man who is the head. There are of course exceptions that prove the rule, but in the main it is an axiom. In each town there is some man who will make the best Chief, and it is decidedly the wisest plan to take a little time and pick him out. He may be a banker, a merchant, a carpenter or anything else that is honest and respectable, but he can be found if a proper effort is made. He must certainly not be intemperate, a politician or simply a good fellow. He should take not only the right interest but pride in the position; he should be intelligent, alert, cool headed, firm and, last but

not least, the kind of man the volunteers will respect first and like afterwards. The man who offers himself with the claim to experience as a fireman elsewhere, should not be chosen unless he also measures up to the foregoing requirements. There is nothing gained by electing a man whose only recommendation is that he has been either a paid or a volunteer fire fighter. He may prove invaluable as an adviser or instructor and yet worthless as a Chief. Of course if the right kind of a man has had experience, it is a very decided advantage and he is the one to elect.

It seems customary to have a Chief, even though there is not at the start more than one company, and this is a good idea if only for the training and experience. One or two Assistants, or as they are occasionally called, "Deputy" Chiefs, are also to be chosen, and each company requires a Foreman and one or two Assistant Foremen. These must be picked with much care, and the foregoing remarks on the qualifications of the Chief will also apply to them, although in a lesser degree. The other officials of the company, such as the President, Secretary and Treasurer, need no comment here, for they can be selected by the same standards as in any other social or fraternal organization. The reason for what may seem to be a surplus of active officers is to make sure that one is always on hand as quickly as possible to take charge and direct, and also for making provision against sickness and absence from town. Following this same idea, the work a company has to do, whether with hose, ladders or other apparatus, should be systematically divided among the members so that each will know the part he has to perform and everything will be quickly attended to by one or more of several volunteers assigned to the various duties. This should be taken up at once, even though the company's first equipment is only buckets, ladders and axes.

Speaking generally, the membership should be made up of men of good standing in the town, who are likely to be at all times ready and willing to do their part. It should not be exclusively the young sprinters who will excel in hose races, any more than it ought to be confined to older fellows not active enough for quick work. The service requires staying qualities at least as much as it does speed and dash. One of the most useful men in the writer's company, thirty years ago, was a cripple who could never run on the ropes, but got to every fire somehow and then was continually busy at the many little duties around the engines and apparatus that no one else had time for. Another was a veteran who ran an engine from another city at the great Chicago fire, had been a fireman since he was a small boy and who practically lived for our company. He never missed an alarm, would stay in a hot place until he was dragged out and with the cripple would work on the apparatus after a run until it was ready for service again. These men are mentioned, not because it is possible or even desirable to form a company of such material alone, but to illustrate the extremely valuable spirit that cannot yet be extinct, and which is worth more to any town than its citizens ever realize.

Pay of Volunteers.

One question likely to arise at the organization of a volunteer fire department is the one of pay. In the old times this was never mentioned or thought of, for firemen were volunteers in a literal sense. This they undoubtedly are in very many cities and towns of the present day and yet we hear of other localities where "volunteers" are paid as a matter of course. An old-fashioned way of looking at this is to consider the firemen's services worth very much more than the citizens can afford to pay, and that, consequently, any small recompense would be an affront. A very practical idea, born of some little experience, is that as a general rule a volunteer department is more enthusiastic, has a better spirit and is quicker and livelier in every way when the members get no pay at all. Furthermore, the demoralization of many such departments has dated from the time the pay commenced, for it opens a prolific field of dissatisfaction and dissension. Should a man feel that he gets out in the snow on a cold winter night for a dollar or two in money,—or for the duty he owes the community, and his pride and interest in his company? Of what use were the volunteers in the Rebellion who went to war for the bounty, or the trifling sum given them?

For the sake of the principle involved and to avoid bickerings in the future, if the question of pay is raised at a preliminary meeting, some good talker should be ready to appeal on the foregoing lines to the manliness and self-respect of the prospective volunteers, and to say something of the necessity of devoting every available dollar to equipment.

The strongest argument in favor of paying volunteers lies in the damage to their clothing at fires; yet the firemen of fifty years ago would have dropped from their company the man who advanced it. Some of this loss is unavoidable, as when an alarm sounds while most members are arranged in their best attire, but much can be prevented by reasonable preparation beforehand. One effective remedy for dissatisfaction of this kind is to be generous in furnishing fire hats, rubber coats and like personal protection. From the standpoint of the citizens and town authorities this is also good economy, for volunteers will work better when properly safeguarded against accidents, cold and wet. The purchase of these very necessary articles should be one of the first subjects taken up when a fire department is organized, and it is also something that should figure in the annual expenditure estimate of every town, instead of being neglected until a large sum has to be spent in a lump.

If nearby towns do pay their "volunteers" and the new firemen insist upon like treatment, it may not be easy to harmonize the various ideas and agree upon a fair basis. We know that the proposition of paying individual members a certain sum for each alarm answered, has been strongly condemned, principally because in many localities it was found to actually cause fires. However, this same charge has been made when a company as a whole was paid by the alarm. A more popular method is to pay each fireman by the hour worked at fires; for instance, a dollar for the first and fifty cents for each succeeding hour. As the attendance

on any kind of an alarm is usually counted as the first hour, whether work is done on a fire or not, this plan is essentially the same as paying by the alarm, but it has a better reputation as to incendiarism.

Mutual Relations.

It is most important, early in the organization of a volunteer department, that there should develop an appreciation of the relations between its members, the municipal officials and citizens generally. If the firemen are to understand that expenditures have a limit, it is no more than fair to impress upon the others a realization of the value of the volunteers' efforts for the protection of life and property. This is not to mean that the department can subsist entirely on words of praise, but is intended to emphasize the absolute necessity of constant support. No doubt most of the town is flimsily built and a large portion might be destroyed in one fire. In many buildings human life would be jeopardized, should flames break out, and a few may be so large that their burning would severely tax the fire department of a large city. Insurance rates also depend materially upon the public protection furnished, and the town cannot in many years afford regularly paid firemen. Unless the volunteers are kept steadfast and maintain an efficient organization, the situation is soon alarming and hundreds of examples have proven that when firemen are not supported and encouraged, they quickly lose interest and become demoralized. This is the true inwardness of most of the numerous town and small city conflagrations we read about, and it is frequently a matter of record that the fire could have been quickly stopped had the department not practically gone out of business. So the matter of sustaining volunteer firemen should be thoroughly studied at the start, and ways found to keep it continually in the minds of the authorities and people generally.

The majority of men in the town, including usually the officials, may get up at night to look at a fire, but they do not want to drag apparatus through mud or snow, or spend hours at actual work in smoke and heat. This must be done by somebody, and certain men agree to do it as a matter of public duty. The obligation upon the majority is plain; they should never forget what they owe to the few who will spare them the burden. The town officials should meet the firemen in a kindly and appreciative spirit, for then they will not be too critical in small matters and differences are likely to be quickly adjusted. Volunteers without enthusiasm are of very little account, and even if at times they ask for more than the town can afford, their requests are entitled to respectful consideration.

It might be said in passing, that ridicule has driven many a good man out of fire departments and impaired the efficiency of not a few fire companies. For the best interests of the town, it is unfortunate that firemen may not be allowed immediately to assault and batter the "village cut up" who guys them from the walk while they are toiling along the road or climbing over a roof. The real harm, however, is done by the

supposedly funny cartoons in periodicals and the comic moving picture films, when they take the volunteers as subjects; a practice that should be condemned and discouraged. For very material reasons, the service is not one that should be brought into ridicule.

Fire Alarm Signals.

The consideration of suitable fire apparatus should proceed during the organization of the company or department, and to get down to beginnings again, as will be necessary if the town is small, the first items agreed upon are likely to be an alarm device and a ladder and bucket equipment. There must be something to give prompt and unmistakable notice of fire, even if it has to be a primitive rail, saw or triangle. A good bell, bronze composition if possible, gives the best satisfaction, and it has the further advantage of being serviceable at the start when rung by ropes on the clapper (wheel and yoke being unnecessary) and equally available in later years for electric striking mechanism. Another advanced device is the compressed air whistle, which may also be operated from a distance electrically, and there has recently been brought out an alarm horn or siren, on the principle of those used on motor fire apparatus. Whatever is adopted for fire alarm purposes should, if possible, be used for nothing else, although there is no objection to repeating the alarm or signal on church bells and factory or locomotive whistles.

It is possible to give a fair idea of where a fire may be by dividing the town into small districts and striking or whistling the number of the district from which the alarm comes. This may be successfully worked with telephone exchanges, the operator being instructed to look at a marked map for the district from which the alarm comes and then to send out the number of that district on an electric line to a bell striker, or over a circuit of call bells in the houses of department officers and firemen. A time-saving idea is to send ten blows or strokes first and then look at the map and strike the district number. Another is to have a card in the exchange showing in what district is the number of every telephone drop on the boards.

Ladders, Buckets and Extinguishers.

Probably the majority of departments start with ladders and buckets, the volunteers being expected to carry them to the fire. This counts for little; the men will never take any interest and those very necessary implements do not arrive until too late. Even in a small town, the time comes when human life will be so endangered that it can be saved only by means of a ladder which must arrive before the person is burned or suffocated. So the wisest plan is to buy a good hook and ladder truck from a reputable concern making their manufacture its business. It should have springs and be large enough to carry a 35 or 40 foot "extension" ladder (not splice), in addition to the "straight" and "roof" kinds. The best patterns of trussed ladders are lighter and stronger than the plain. In addition to the usual equipment of axes, pike poles, lanterns,

rope, "pull down hook" and chain, there should be carriers for fire hats and rubber coats and a large supply of practical buckets. Such a truck will be strong enough to draw behind a horse vehicle or even an auto truck, if care is used, but if planned to be a paid department machine at some time in the future, it is likely to prove too heavy for hauling by hand. All equipment for volunteer use should be strong and simple in construction and capable of withstanding considerable neglect.

A machine of this kind will arouse and keep up interest and enthusiasm in the company, and will be serviceable for a great many years. Storing it in an old barn or cowshed is, however, very poor policy; a suitable house should be ready by the time the factory can build, paint and varnish the truck. Mention of paint, by the way, is not for the ladders, as these are decidedly best in the natural finish, oiled. Unless fire apparatus can be kept in a proper place and is to have reasonable care, there is little use in carrying extinguishers; they are so generally neglected by volunteers that one almost fears to recommend them. They will prove extremely useful if kept in good order and prevented from freezing. Two "soda and acid" extinguishers, of a kind that bears the Underwriters' Laboratories' Label, and two portable pumps, are a very desirable equipment for any hand truck; by the latter are meant the closed copper or galvanized iron pails or tanks, with hand pumps and hose attached. They are used in the fire departments of Chicago and many other cities in this country; in Europe they are much more common, and one name for them there is the "Hydronette." For fires in small closed spaces they are not as effective as extinguishers, for roof fires they are not as convenient, but for general work, especially in the open air, and for protecting an adjoining building, the pumps are more serviceable. Using only plain water, which can be poured in while working, recharging is easier and quicker.

A chemical tank on a hook and ladder truck is a useful accessory, always providing the apparatus is kept in a secure place with warmth in winter and proper care. But it so increases the weight of a hand truck, requiring, as it does, a stronger frame and much bracing, that it can scarcely be recommended unless grades are light and the streets in good condition all the year round.

The Chemical Engine.

In a volunteer department the chemical engine, which may be said to come next in order, is a subject that requires careful consideration. Under favorable circumstances—most of which are rare—it is an extremely valuable machine, and under others it is nearly worthless. The best engine on the market will not be efficient if left to care for itself, and unless it be taken promptly and speedily to fires and intelligently used after getting there. If very light and portable, the tanks are so small as to be worth little in fighting a fire of any size: if the capacity is large enough to throw a useful stream, with facilities for keeping up that stream for a lengthy period, the weight of the apparatus is almost pro-

hibitory. The first fire a "volunteer" engine goes to usually determines its success or failure. If the blaze is inside a building and the firemen attack it successfully, or if by skillful handling of the stream they save an adjoining house, they will acquire a confidence in the engine that subsequent defeats are not likely to impair. But if on their first trial they come to a building wrapped in flames on which their best efforts make no impression, they will be promptly disheartened and the town might as well organize another company or sell the machine. By the time volunteers can be aroused at night and a heavy chemical engine drawn over muddy roads, up and down hill, to a fire, the situation is usually beyond their best efforts and everybody takes a fling at the "soda fountain squirt."

If the outlying property owners can be appeased, the wisest plan might be to locate the machine in the center of the business portion and have an understanding that it is for the protection of the "high value" district alone. What would happen, though, when some woman taxpayer's house burns on the outskirts of town and the fire engine does not stir, may be left to the imagination.

In the writer's experience, a double 120 gallon tank machine with side ladders and several extra charges did wonderful work in a town of 5,000 population, where there was no other protection,—no water except in a few deep wells. The record was so good that when a gravity waterworks system replaced this engine, the insurance rates in the business section were actually raised; the reason for this being given as the prospective water loss. It shows what can be done with a "soda fountain squirt" in a place where high winds and frame buildings are the rule, but the conditions there were practically those of a paid department. There were two full-paid men, a pair of horses and swinging harness, in addition to a live volunteer company.

These ideas may offer suggestions to those considering a chemical engine as next in order after the hook and ladder equipment. It is not so much the machine itself that requires careful thought as the local conditions and the prospect for proper handling. If the town officers decide to invest, they should remember the best is the cheapest and that the standard kinds will prove the wisest economy. Let them take no action until reliably informed of the actual weights of different sizes, fully charged and ready to go to a fire; then one or more can be selected not heavier than the condition of the streets will justify. A gallon of water alone weighs eight and one third pounds, and to each five gallons there will be one pound of sulphuric acid and two pounds of sodium bicarbonate. Some builders will furnish a much better machine than others, but it is difficult to save weight without sacrificing strength.

A four wheeled engine is much easier handled than a two wheeler; the weight is better distributed and the pole does not slam the men around so. A continuous stream may be kept up from double tanks, by recharging one while the other is in use, but unless unduly heavy they must be small and of limited power and capacity. Two single tank machines, each

with a capacity of at least fifty gallons, will prove more efficient for hand use, than one large engine. Until the basic patents expired, there was bitter rivalry between the rolling and stationary tank patterns, the original "Babcock" being of the latter style and likewise the "Holloway." The one in which the tank turned upside down came into prominent use at the Centennial Exposition of 1876 and was called the "Champion"; it was first fought and then absorbed by the "Babcock" company. A few years later it was much improved by placing the tank flat, with the lead acid jar in a manhole on the upper side instead of the end. Being top heavy, it was easily rolled over, reversing the jar, from the opening of which the heavy lead stopper dropped slightly, allowing the acid to flow into the alkaline solution. Most of the commercial fire extinguishers are made on this principle now. The tank was tinned steel, light and good for twenty years wear when well made; there were but two openings to keep tight. The criticisms usually were on the lack of a pressure gauge and of an "agitator" to prevent the soda from settling to the bottom.

Tanks of the stationary "Babcock" or "Holloway" type, were also first vertical and then horizontal; they were copper, with acid bottles of glass in the early days and later lead. There were from seven to nine openings in each tank. The acid jar was well above the water line, a decided advantage, and the devices for operating it were many. The general principle was to turn over the acid jar on trunnions, after a stopper screw had been raised to release it; the acid then flowed into the soda and water. There was a pressure gauge. The "agitator" might be turned after action commenced, but this was not necessary; the chief use of that adjunct was to stir up the solution at intervals when the machine was standing in the house, to make sure the soda was well mixed.

Care in recharging has much to do with the successful working of both chemical extinguishers and tanks. In the first place, there must be a good quality of acid and the best of dry, clean soda. The latter should be well dissolved in a pail and be all in solution, without lumps, when poured into the tank. Results will then be quicker and stronger; the acid is neutralized by the soda, thus preventing damage to goods and clothing, and there is not likely to be any settlement or caking at the bottom. To dump in a can or sack of soda and then pour on it a stream of water, leaves undissolved soda from the start, causes lower pressure and compels the use of an "agitator." It is necessary to remember that no tank or extinguisher is to be filled full; there must be an air, or rather a gas, space above the solution.

The names "Babcock," "Champion" and "Holloway" may be regarded as historical now, for otherwise they mean only styles or patterns, and are advertised as types by many. All the largest manufacturers of fire apparatus are prepared to furnish stationary or rolling tanks as desired. The point is that at the present time the most popular chemical engines closely follow the old standards in large cities as well as small towns. Many other varieties have been placed on the market in the past thirty years, and doubtless some have used more powerful extin-

guishing solutions than are generated by soda and sulphuric acid. But they are not popular in other respects; the fluid is expensive, or it has to be brought in bulk for recharging at a fire, or it is corrosive or its fumes are objectionable. Sometimes, if the power is compressed air, there are leaks, or the valves stick fast or there is too much complication. For one reason or another, they do not supplant the old styles.

Fighting a fire with chemicals means close, hot work, and the man who does it well gets the best possible training for a fireman. Men on the nozzle must have fire hats and heavy gloves or mittens; rubber coats are too hot. Many volunteer companies have used light wooden folding shields, covered with asbestos and about the size of a common door. These are carried on the apparatus and are of great service when the stream has to be held between a burning building and another nearby. The valve on the playpipe is kept open, as this will cause less trouble in case of sticking, but it should be closed while entering the burning building and not opened until the stream can strike the heart of the fire. Every drop thrown must reach this point; if it cannot, the nozzle shut-off is to be promptly closed until there is another chance. In this way, a tank that would discharge ten gallons to the minute, with free flow, may be made to last a quarter of an hour or more.

The benefit of the carbonic acid gas, which makes the solution theoretically of forty times the extinguishing power of plain water, is chiefly found when the stream goes into wall, floor or attic spaces, or, under some conditions, upon oils. This gas is heavier than air, but in actual practice at open fires, all such extinguishing gases are largely carried away by the uprushing currents of air. However, if the stream were no more efficacious than water alone, it would be of very great value because of the quickness and heavy pressure. The latter is developed in the hose as well as in the tank; if the line be uncoupled from the engine while working, the solution will be forced from both ends of the hose. For this reason, friction does not count for so much as in a water line, and the stream from hose carried up a church steeple or high building will be nearly as strong as on the ground.

Automobiles.

Automobiles are making wonderful changes in the fire service, but it is doubtful if these can benefit a department not yet able to procure a water supply. The many kinds of motor trucks and chemicals on the market, separately and in combination, are likely to be too high in price, and road conditions would be very much against them. The same might be said of motorcycles fitted to carry extinguishers. Until a town can afford the pay of a man to look after its auto apparatus, there will be little inclination to spend a large sum for such a machine. However, something might be done by volunteers themselves with the automobiles they can command; for instance, they could take extinguishers, portable pumps, axes and buckets to a fire so rapidly—if the streets were good—as to control a blaze that might be entirely too much for them after

arrival with the larger apparatus. During favorable periods of the year, a system of this kind could be worked very successfully, and might well be carefully planned. It would be of great advantage in case a fire in some large building showered the shingle roofs of the town with sparks and brands.

Hand Engines.

Almost any water supply available for putting out fires changes the situation materially. If this must be artificial, as in the prairie towns of the West, it may be a long time in development, but canals, rivers or larger bodies of water, usually afford facilities for pumping and greatly simplify the problem. From the time that history first mentions what we call a hand engine, as used in Alexandria, Egypt, about 150 B. C., to considerably past the middle of the last century, this machine was considered the last word in fire extinguishing. It is quite interesting to reflect that for two thousand years the only means of protection were these man power pumps, syringes, pails, swabs and like crude devices. We are not surprised at the long list of sweeping conflagrations; the wonder is that there were not more. Rome is said to have had a population of a million and a half at the time it burned in A. D. 64; yet that historic fire was fought with nothing more effective than large syringes, swabs and pails. London had five such disasters before the memorable one of 1666. A mention of fire engines in Augsburg, Germany, in 1518, is the first that can be found in history for many centuries. Hose came into use in Amsterdam in 1672; it was of leather and carried water to the pumps instead of away from them. Within a hundred years of the present time the stream was directed from a flexible pipe or nozzle on top of the machine. The first engine in America came from London to Boston in 1678, and that city had six before there were any others in the colonies. During the palmy days of New York's famous volunteer fire department, or say from 1835 to 1860, the hand engines were large and powerful machines, drawn by men and so arranged that a large number could work on the brakes.

But the glory of these engines is all in the historic past. Volunteers will have nothing to do with them now, even though the "tubs" occasionally built at the present time are light, well designed and powerful. Probably no other fire apparatus withstands neglect so well; about the only attention needed is to keep the pump leathers from drying out. But the labor of working them is exhausting to the last degree, and rather than resort to the necessity of having the town policeman force men to work on the brakes under threat of arrest and a sojourn in the calaboose, boards and councils have turned their attention to something more modern and less discouraging to the enthusiasm of the volunteers.

Hand Gasoline Engines.

The next choice lies between the gasoline and the steam engine. Small and inexpensive machines of the former type are now on the

market, and they are well spoken of in the towns that use them. But it does not appear that sufficient attention has been given to making gasoline pumping engines what they ought to be for volunteer purposes. The old hand engines, for instance, had the great advantage of simplicity, but their material and workmanship were of the very best, and any machine to be depended upon in the small towns must be built as well. The gasoline engine is a rather complicated affair, and it is necessary to provide for a great many contingencies. The large cities buy only after thorough investigation, and then have skilled men to keep the apparatus constantly in order. The small places have little expert knowledge in purchasing, and even under the best of circumstances must count on a certain amount of neglect. Hence the engines for the little towns might well be even better in quality than those for New York or Chicago, for a fire in the one may be proportionately as dangerous as a fire in the other, and breakage, or other failure when a department has only one machine, is much more serious than if there are forty or fifty available.

The town proposing to buy a small gasoline fire engine, should use every effort to secure one thoroughly reliable and durable. It is unfortunate that there are not more reports of official and scientific tests of such machines by competent and disinterested authorities, but the work, at chiefs' conventions at least, has been confined to the large automobile engines. It is important for purchasers to know just such facts as these trials bring out, for they should be the best proof of first class design and construction. Even ten years or more of service in a given locality is not test enough if there are only two or three working fires in twelve months, and many little towns do not average that. Every machine bid on should be thoroughly examined by gasoline engine experts in whom the authorities have confidence, and their opinions ought to prevail in the matters of material and workmanship. For the pumps, the patterns that have proven successful in the cities are the only ones to consider. Even the smallest engine drawn by hand should be able to furnish one standard stream of 250 gallons a minute, through 300 feet of 2½-inch hose and a 1⅛-inch nozzle, and a good fire stream with 1,000 feet of the same hose and a ⅞-inch nozzle. And this must not be on "pop squirts," but for twelve hours continuously, with no breakage, overheating or failure, to prevent several hours more of work, should an emergency require it. An inspection and test of this sort ought to be first on the reception program, before any parade, oratory or dance.

Once in service in a good house, a competent volunteer is to be placed in charge, and he and three or four others well drilled in running the engine. There are many advantages in this kind of a machine; it is light and easily drawn over ordinary roads, it will get to work quickly, has great power in proportion to its weight, can be handled by almost anyone familiar with an automobile, runs with remarkable regularity, and if first class in design and construction, can work steadily for a day or two. The equipment ought to include a relief valve at a pump outlet, at least twenty feet of the best quality smooth bore rubber suction hose,

a brass strainer or "basket," and a reducer for connecting suction to hydrant. A reliable combination pressure and vacuum gauge should be on the pump. Lanterns and all polished brass work are best nickel plated. Cheap valves and fittings always indicate cheap and poor workmanship.

The authorities will of course set a proper example by keeping the gasoline supply in an underground tank, according to law, and it is necessary to provide two or three heavy metal safety cans, of at least ten gallons capacity, with wire gauze in the outlets, to be filled in case of a working fire and brought to the engine in automobiles. Cans of lubricating oil must also be kept in reserve. The 2½-inch hose is usually carried on two or more substantial hose carts; not mill carts, but a kind sold and warranted by a reliable fire apparatus builder. Many a house has burned completely because a flimsy hose cart broke an axle or dished a wheel in some "chuck hole." The old style four wheel hose carriage, if plain and strong, is a much better investment than the common two wheel cart, and in many instances light hose wagons for hand use have given better satisfaction than either.

Steam Fire Engines.

The steam fire engine, to be drawn by men or fitted with a combination pole for the first team that can be brought, should not be heavier than a third size, as this will weigh close to 7,500 pounds as it goes to a fire. Machines of this class have thrown over 700 gallons a minute, and kept up an efficient fire stream through more than 2,000 feet of 2½-inch hose. The best known builders formerly turned out fourth, fifth and sixth sizes, the last two only for hand draft and volunteer companies. The weights of these, ready for service, were about 6,000, 5,000 and 4,000 pounds respectively, and they were generally rated at 500, 400 and 300 gallons a minute. For volunteer service, they could always be depended upon as first class in construction; they were simply smaller models of the large city machines and any failures were usually due to neglect or ignorance in handling. The coming of the gasoline motor engine has, however, discouraged the production of the smaller steam engines, and the third size is now about the smallest manufactured.

There should still be a place for a plain and substantial steamer of small capacity and light weight. Such an engine would be greatly superior to certain cheap cast-iron gasoline engines a number of small towns have been induced to buy.

Many years ago about a hundred letters of inquiry were sent to towns and villages using steamers, and the replies developed that 44 localities depended upon rivers and other large bodies of water for supply, 44 upon cisterns, and 15 upon both rivers and cisterns. The average cost per year of maintaining each engine, for fuel, oil, etc., was $39. In 27 instances no one connected with the engine companies received any pay; in 61 the men in charge of the steamers received from $25 to $300 a year, and in 15 all the volunteers were paid small amounts. In 58 towns the engines

were drawn by hand to fires, in 37 from one to ten dollars were paid the first team appearing on an alarm, and in 5 horses were kept for hauling the steamer, generally working on the streets during the day; 74 towns reported that the engines had caused a lowering of insurance rates and 14 declared to the contrary. All wrote in terms of praise of the satisfactory working of their steamers, and the most popular sizes seemed to be the fourth and fifth. The majority maintained steam in separate heaters and generally the cost of fuel for them was included in the maintenance.

These figures, while not recent, will serve as suggestions to those considering the purchase of a steamer. If the hand gasoline engine could be called as reliable and durable as the steam machine, the latter might as well be forgotten, but the town that cannot afford a first class automobile "pumper" makes no mistake at the present time in buying a small "piston" steamer of a standard pattern. The equipment furnished with the machine by the old established builders is generally ample; if more is desired it can be added in the specifications. As with a gasoline engine, the tests to be performed should be in the contract and carried out in detail, after the new apparatus is built and delivered, with some competent person supervising for the purchasers. A delivering engineer usually runs the machine then and instructs those who are to have charge. A steamer does not use much coal and oil, and the best economy is to buy both of the finest quality obtainable. The contract ought to include a regular engine heater; these are not expensive, either in first cost or in maintenance; they need attention only twice a day, provide steam enough to go to work as soon as the fire is reached, and prevent freezing in winter. A portion of the coal should be kept sacked in readiness for a run of several hours, as the engine cannot carry a large quantity, and a reserve supply of oil is also nceessary. The care of a steamer is simplified and cheapened by having all the bright work heavily nickel-plated, and this is now the usual practice. The old polished jackets on boilers were a delusion; they are of no particular value in preventing the radiation of heat, and water is apt to "pocket" under them and rust the shell. Bare black boilers, with nickeled bands, dome and stack, are now the rule.

The successful steamer engineer is not necessarily an expert mechanic or runner to begin with. Like the man who is to handle a gasoline engine, he needs a good working knowledge of the machine, but it is at least as important that he take a thorough interest in his work and a pride in making it a success. He must be sober and level-headed at all times and naturally painstaking, so that the engine will be kept clean and in order. When such a man is up to the mark and has his machine always neat and ready, starts the water as quickly as the firemen want it and keeps it coming to the last, he should be engineer as long as his services can be retained, even though his politics and religious belief are not popular. One reason for the success of this kind of a man is often that he does not tinker and take the engine apart unnecessarily. As a standard style and make of steamer comes from the builder, it should give efficient service in a small town for twelve or fifteen years without

overhauling, barring accidents and breakages; yet many a machine has been spoiled by meddling or foolish efforts to improve it. It is most important for volunteers and town officials to understand that the engine will do the work if well handled; that it must always have a sensible and practical man in charge. If this can be accomplished, there need be no trouble, but beware of the man who wants the job simply for the money.

The acquisition of waterworks systems, real and alleged, has caused a great many towns to neglect their steam fire engines or offer them for sale. This is not wise, for the machines are worth very much more to themselves than any sum they are likely to get. Second-hand apparatus usually sells for a very small price. It should be realized that there must be protection against the unusual as well as the ordinary fire; that when a great burst of flame comes from some inflammable building, and a gale of wind is blowing, all possible help and everything that can throw water are urgently needed, and the stream from a good steamer, which has been kept in order and is well handled, is likely to be the only one strong enough to make any impression. The average small town waterworks system serves very well for fires in dwellings and small buildings, but even a village has at least one place where a conflagration may start and this is often the industry that keeps the town alive. When a fire gets under way there, lines of hose are put on to the limit of the capacity of the waterworks, and we have the same old stories: "We couldn't hold our ground—the streams wouldn't go into a second story window—it was so hot we could not get near enough to hit the fire." This describes the critical moment when a steamer—and five years of paying out small sums of money for an engineer, fuel and oil—would probably save the town a hundred thousand dollars. The only sensible policy is to hold on to every serviceable piece of fire apparatus, and keep it in order and readiness for the great emergency coming sooner or later.

Rebuilt Steamers.

Sometimes a second-hand steam fire engine can be bought at quite a bargain, and then the council or board seeking protection is greatly attracted by the low price. Such a proposition should be considered very carefully before action is taken; the machine may be all right, but the chances are about four out of five it is not. Before a sentiment to sell a steamer crystallizes, there is usually a period during which the machine has stood without care; "they have a waterworks and didn't need it," and this means a leaky or foul boiler, rust and general deterioration. It may have been temporarily fixed up, so as to make a fair exhibition test and yet be unfit for hard service. By far the safest plan in buying a second-hand engine is to secure it for the lowest possible price and then contract with one of the best known steam fire engine builders to overhaul it completely, put on a new boiler, new suction hose and new valves in pumps, repair the machinery and gear, repaint and varnish. The result will be an engine almost as good as new and at little more than half the cost. This is recommended only for machines having vertical "piston"

pumps and there are more than half a dozen builders of that style. The "rotary" had a great sale at one time and was in theory the better pattern, but while some of the machines gave twenty years or more of good service in the hands of unusual engineers, the majority were short lived.

Waterworks Systems.

The most popular public fire protection to-day is the waterworks system, largely because it provides a supply of water for all other uses as well. It will justify the dependence placed upon it if properly built, and unless the former purpose has been so subordinated to the latter as to leave only weakness and inefficiency for the fire service. There is now no lack of civil engineers who make municipal water supplies their specialty, nor of books which go into detail on the subject, so it is unnecessary here to attempt to say what is a good system and what is not. But it is true that adverse circumstances, or an unwise economy, often hamper those laying out a water plant, and for this and other reasons the small towns so supplied are usually weak in the matter of adequate fire protection. Right here it may be said that the systems so common in the Central West, of a windmill, a low tank and a mile or so of pipe, with so called hydrants, are not being considered at all,—they are practical waterworks only in their boom literature.

If a real waterworks system is to properly serve the fireman's purpose, it must furnish and well distribute both supply and pressure sufficient for the needs of the town. In many small localities there may be sixty pounds on the hydrants, and for a term of years this may prove enough. The engineering experts will say that a pressure of eighty pounds is ample, and it is for all ordinary fires. If these figures can be depended upon at all times, winter and summer, such systems have the merit of reliability, which is of first importance. In anticipation of a very threatening fire, when the ordinary pressure would be insufficient, there is usually a provision for increasing it by direct pumping or otherwise, and this is a matter that should be carefully looked after by those interested in fire protection. Turning on more pressure from a gravity supply is not hazardous if only so much can be added, as is usually the case, but with pumps there must be a great deal of precaution taken. Suddenly increasing the pressure, in an old system especially, is apt to tell on some weak main or joint, and if it gives way there is likely to be utter helplessness, if not tears of regret because the old steamer was sold. As before remarked, it is far better to have one or more good fire engines for increasing the pressure outside of the hydrants, than to try forcing a system not strong enough to withstand the strain.

With the best water plants, as well as the poorest, it is very necessary for the firemen to thoroughly inform themselves as to what may be expected from the hydrants in different parts of the town and under various conditions. This will render them less likely to put too many streams on a fire; a mistake that is common enough and which always proves disastrous. The hydrants within reach of every block will supply just so

many streams without weakening the pressure and no more. Four streams of water, with eighty pounds maintained at the hydrants, are likely to mean success in a big fire, while if six more are added and the pressure drops so that all ten are weak, failure is certain. In such cases the usual outcry against the water system is decidedly misdirected.

When the installation of waterworks is being discussed, the Chief and firemen should post themselves on the subject at once, and be the special advocates of the best possible fire protection. It is both their right and their duty to urge, within reasonable limitations of cost, the strongest and most reliable pressure, mains of the best material and as large as can be afforded and first class hydrants and plenty of them. Of the latter, a very eminent hydraulic engineer once wrote: "Innumerable patterns of hydrants are urged upon water companies and engineers and are accompanied by an abundance of certificates setting forth their excellence. Many of them have good points and will answer all practical purposes until an emergency comes, when they fail and the experiment winds up with a loss that would have paid for a thousand reliable hydrants." This statement is true to the letter, and moreover, it has a general applicability to the fire service. Substitute gasoline fire engines, steamers, chemical engines or almost any other horse or automobile apparatus for the word "hydrants" and it is just as correct.

Hose.

It is hardly necessary to say that with anything from a hand engine to a complete waterworks system, a fire department should use for throwing water only the standard hose of two and one half inches interior diameter. The saving in cost of smaller sizes counts for little in comparison with the disadvantages. Whatever power is used to force water is too valuable to be wasted in friction loss. A good stream may be thrown from a long line of standard hose when the same length of smaller diameter will furnish only a weak one. Under conditions in which one pound of pressure is lost by friction to each one hundred feet of 2½-inch hose, about three pounds are lost in two-inch and more than ten in inch-and-one-half. If the pressure is not strong on entering the hose, the size of the nozzle opening should not be larger than will throw a suitable stream, but the idea is to bring as much pressure as possible to the nozzle. Moreover, as the town grows, standard hose, outlets, couplings, play-pipes and other fittings will still be serviceable, and in case of a very large fire, the engine or hose from another department may be attached, and give help that would be otherwise impossible. Rubber hose, or as it is sometimes called "canvas," is made of a number of plies—usually four—of canvas or duck, saturated and then lined with rubber. When finished the inside and outside surfaces are both smooth rubber. It is more expensive than cotton hose, heavier, less pliable and not so strong. On the other hand, there is no outside fabric and nothing to dry after using, hence a duplicate supply for each hose cart is not needed. First class rubber hose has lasted in volunteer fire departments longer than high

grade cotton and with very little care, but only the best quality can give such results.

Cotton hose is made of one, two or three tubes of cotton fabric woven singly or in "multiple." If singly, one is drawn inside of the other and the inner one is lined with rubber. It is strong, flexible and the popular favorite, but the fabric must be carefully cleaned and dried after using. Hence there should always be an extra supply to put on the cart or reels while this is being done. The lining itself is best kept cool and moist, and it must not be forgotten that as soon as the lining gives way for any reason, the hose, or that part of it, will leak and become worthless. There can scarcely be too much care given to cotton hose. After it is washed it is usually hung in towers; the hanging does not injure either the hose or the attachment to the coupling. In many places it is laid on ventilated racks, but in neither case should all the moisture be taken from the lining. If it goes on to a reel or wagon before the fabric is thoroughly dry it will mildew.

Every town needs a pressure pump (hand), for testing all new hose as it is delivered and before acceptance, in order to see that the department is getting what it ordered. This pump is also necessary for trying out all old hose at regular intervals; at these times the pressure should not exceed what the hose is expected to stand in fire service. Whenever newly bought hose arrives, the contract tests should be carried out in detail, but only a few sections, selected by some disinterested person at random, ought to be put under the extreme pressure to which it is guaranteed. It may be necessary to send a piece to a chemist or testing laboratory, for some of the requirements, but it should be done. The hose specifications of the National Board of Fire Underwriters are reasonable and fair and any purchaser will do better by using them. From a town's standpoint, there can be no reason why specifications are not as necessary in buying hose as in contracting for any other material equipment.

Couplings.

All sorts of clutch, clamp and other "patent" couplings have been placed upon the market, but few of them are in use, although one or two kinds may be theoretically better than the common screw variety. If we may judge by the popularity of the latter, it has proven itself the most durable and reliable for hard service. But for uniformity alone the screw coupling should be the one adopted, and there need be no fear of regrets in the future, with a coupling so practical and free from complication. Those who fear a loss of time in attaching a screw coupling to a hydrant or engine may use some of the quick acting devices designed for that purpose, but as a matter of fact there is always plenty of time for making those attachments before the hose line is ready for water. Additional appliances are unnecessary and a complication.

The only practical method of putting couplings on fire hose is what is known as the expansion ring process, which has the further advantage of leaving smooth surfaces inside and out, and no lugs or bolts to wear

holes in the hose. The work is done with an "expander," an inexpensive tool that even the smallest fire department should have. Accidents and burns requiring the moving of couplings are not uncommon, and a few minutes of labor with an "expander," will save the cost and delay of sending much needed hose out of town.

While the screw coupling is by far the most common in this country and Canada, there was at first, unfortunately, no system about its adoption, and innumerable styles and sizes came into use. It has been said that in one Eastern state there were eighty different "threads," and few of them were near enough alike to couple together. Undoubtedly some manufacturers undertook at the start to furnish their own exclusive patterns; they ended by being obliged to keep a hundred or more different templates or "sample threads" so as to be able to make couplings for different towns and cities. The multiplicity of styles, both screw and patent, caused expense, delays and general confusion. At a number of great conflagrations firemen brought hose and apparatus from other localities and then found themselves unable to connect to the local hydrants. This was well illustrated at the great Baltimore fire of 1904, when 33 engines were brought from elsewhere and most of them could not attach to the excellent water system. Their couplings would not fit and so they pumped water from a stream which, by a fortunate chance, happened to be available.

This gave a new impetus to the demand for a standard hose coupling. Various organizations and bureaus collected statistics, and after much research and discussion a certain plain screw coupling was decided upon because it would fit more existing couplings than any other. Specifications were published, giving all dimensions and measurements in detail, and these were adopted by the different associations interested. Many large cities made the change from their old couplings at a considerable expense, while others were so near the new thread that only trifling alterations were necessary. There is no longer any question of either the permanence or the popularity of this National Standard, and every city, town and village should adopt it for couplings on hose, hydrants and apparatus of every kind. Illustrated specifications, complete in every detail, may be had from the U. S. Bureau of Standards in Washington, D. C., the National Fire Protection Association in Boston, or any of the large organizations of underwriters.

One of the many advantages of this National Standard is that when ordering anything carrying a coupling, it is no longer necessary to send a sample to show the thread. That practice often resulted in new shapes and sizes, because of the individual ideas of the mechanic working from such a pattern, and as these slight differences were multiplied year after year, the new couplings became more and more unlike the old. The two words "National Standard" in the order or contract, render all further descriptions, measurements or samples unnecessary, and the work must be done by printed specifications, exact in every detail. If these are followed, a coupling made in San Diego, Cal., will precisely fit one turned out in Halifax or New Orleans.

Playpipes and Nozzles.

In the old days of hand engines, the playpipes were very long and tapering, the idea being to "pack" the water before it came out of the nozzle. Some of those in common use were five feet over all. Whatever the effect on the streams, they were entirely too awkward, so in recent years the tendency has been to shorten them until the popular lengths are now from 12 to 18 inches. In many departments the nozzle goes directly on the coupling, and the holder is clamped on the hose itself; this type also includes a device for taking the "whirl" out of the column of water, and the result is very fine streams. Tests have proven that long pipes serve no practical purpose. Playpipes are almost universally wound and painted for ease and comfort in holding. The old flexible rubber pipes are now very seldom used.

Some very ingenious "shut off" nozzles have been placed upon the market, but most of them are too complicated and the movable parts too easily broken or otherwise rendered useless in the rough service that is unavoidable. A good shut-off must close tightly without leakage, operate easily under heavy pressure and not obstruct the stream. Above all, it must close slowly, or rather it must be impossible to stop the moving column of water instantly. The "ram" or "hammer" is enormous when the stream is shut off too rapidly, and the resultant strain on the hose most injurious. Most of the shut-off nozzles in use are too sudden in their effects and they are also very hard to keep tight after long service. The regulation nozzle in San Francisco, and in most of the California towns, has a very practical and slow moving shut off at the base of the pipe, and another hose thread where the latter joins it. In case of need the gate may be closed, the pipe unscrewed from it, one or more sections of hose coupled to the closed gate, thus lengthening the line, and the pipe without the gate screwed to the new end. Or any other water throwing device may be put on.

Basement Pipes.

As basement and cellar fires are sure to quickly destroy a building unless controlled, and the handling of them is a most difficult and dangerous proposition, every department needs a revolving nozzle or distributor, to put down through holes in floors, and a cellar pipe for the same purpose and also for use under roofs and docks. Seattle and other Washington cities require basements containing merchandise to have permanent systems of 2½-inch iron pipes, running to front, center and rear, with revolving nozzles at one end and hose couplings at the other, outside. Every town should require these unless basements are sprinklered, and such pipes can be used to advantage in many other dangerous situations. Of course in small fires, when men can easily get into the basement and work, the hose lines are not attached to the cellar pipes.

Fire Alarm Telegraph.

Taking it for granted that a volunteer department is duly organized, and is in service with apparatus in accordance with the foregoing suggestions, the first improvement, as the town can afford it, should be in the fire alarm. If a start was made with simply something to make a noise when a fire breaks out, there ought to be no time lost in installing a telephone—district arrangement as described before, presuming the 'phones are fairly well distributed. Then, keeping in mind the necessity for means of giving a prompt and definite alarm, the matter of a real telegraph ought to be taken up as soon as money can be spared for that purpose. Often in the late hours of night the delay in getting at a telephone may cause the loss of a building. It is worth while to commence with even three or four fire alarm boxes if no more can be afforded, for these with electric mechanism capable of striking a bell, blowing a whistle or giving some similar loud alarm, will be of great assistance to the firemen. Such a system may be enlarged at will by the addition of more boxes, strikers, gongs, etc., but it is very important that a right start be made. When the citizens once realize the value of an alarm telegraph, there will not be much opposition to extensions, if the money can be found. In many instances also, factories, mills and railway shops buy alarm boxes and connect them with the system.

In selecting fire alarm telegraph equipment, it is absolutely necessary to investigate carefully and choose only the best of everything. A plant of five boxes, a striker and two or three gongs, that is always reliable and remains so without constant tinkering and worry, is worth very much more to any town than one of three times the size that gives alarms when there is no fire and refuses to sound when the danger actually comes. Almost any electrician can put up a signal system that will do well on a carefully prearranged test, but what is needed is one that can be depended upon for ten or even twenty years under all circumstances. An alarm box, for instance, must stand out in all kinds of weather, heat, cold and storm with very little attention and yet work perfectly at any time, day or night, possibly months since it has been opened. The same perfection of mechanism is required in strikers, gongs, switchboards, etc., and it can only be secured from a builder who has had ample experience in that line of work and possesses the proper machinery and facilities for turning it out.

A small town does not need the costliest and highest type of alarm box, for the lower priced ones, as made by the best known manufacturers, are entirely reliable. As the place grows, these can be moved to the outskirts and better ones secured for the business district. All such boxes will work together on the same circuits. It is an advantage if the alarm boxes be what is called "non-interference," which virtually means that if a second box be sent in or "pulled" while the first is transmitting an alarm, the action of the latter is not interfered with. In any town or city if a fire breaks out with a burst of flame and smoke that can be seen for several blocks, from two to five boxes may be pulled practically at once. If the system be not "non-interference," the pulling of two boxes at the

same instant will mix up the alarm and sometimes prevent the striking of enough blows or whistles to arouse the volunteers.

When an alarm telegraph is started in a small way, it may be worked in combination with a telephone—district system. The town is divided into small sections, numbered in a regular and easily remembered sequence, and when possible, the telephone exchange is furnished with a well kept up list of the switchboard drops connected to each district. Such alarm boxes as are installed will have the numbers of the districts in which they are placed, and all these numbers should be short, as 12 to 18 inclusive, 21 to 27, 31 to 36 and so on. Figures under 12 are best reserved for signals. In the exchange is placed a "manual transmitter," with "character wheels" numbered for each district, and sometimes others for a noon test, signal for a meeting or a drill or other like purpose. If an alarm box is pulled, the telephone operator has nothing to do with it; she will hear the alarm on her small bell or gong and on the large bell or whistle. When a telephone call comes for a fire, she will note the district it is from, place the character wheel with that number in the transmitter and start the mechanism. At once this number will be struck four times on all bells, whistles and gongs, just as though an alarm box had been pulled. If this is done at least once every day, as for instance a time signal of three blows at exactly noon, the system will be tested and the operator will have the necessary practice.

Such a system is of course not so good as a complete one with boxes distributed everywhere over the town, but it is far better than the old haphazard fashion. Of course it cannot be so much as considered without the active co-operation of the telephone management and unless a capable operator is constantly on watch. It should be remembered that at least half the trouble with alarms by telephone is due to the carelessness or impatience of the person receiving them. Even though a very excited person is talking, a competent and painstaking operator can make sure there is a fire and get the location in very much less time than it would take a man to run several blocks to the fire bell. Possibly somewhat more effort is necessary if "party lines" run through more than one district. We all know that the use of the telephone is growing continually and that practically every one turns to it first in case of trouble or accident. In many of the large Western cities, two thirds of all alarms come in by 'phone. Every town, small and large, should have an intelligent and adequate method of handling such calls.

Some one person, whose continued interest may be depended upon, must have the care of the fire alarm telegraph. If he can do a lineman's work so much the better; if not, assistance of this kind should be arranged for elsewhere. There is not much to do except in case of a severe storm or disaster, but a little attention is needed regularly, and when the necessity arises for something more it cannot be postponed.

Motor Fire Apparatus.

The growth of a volunteer department is largely a matter of local conditions, and it may take so many different forms that it is impossible to comment upon them without covering entirely too much space. When the town's finances will allow the payment of firemen's salaries in part or full and there is some money available for higher priced apparatus, consideration can well be given to automobile machines. A few volunteer departments claim to have made a success of handling these under the care of a man who only gives a portion of his time; a greater number undertake this responsibility with men fully paid. Either plan might succeed or fail as circumstances developed; certainly the prospects will not be bright in either case without a thoroughly competent and faithful man in charge. In a small place the maintenance is a much more serious matter than the purchase, for reasons that have been mentioned on previous pages, in writing of other kinds of apparatus.

After the town authorities have decided upon what sort of apparatus they wish to buy, whether plain hose wagon, "combination" wagon, pumping combination, or other style of automobile, there is no lack of disinterested information as to details. Most of the cities have tried more than one pattern and a large number of elaborate tests have been made by engineering and fire experts, and the reports of these are most complete in all the facts and figures that any prospective purchaser might want to know. For probably the first time in very many years, he is not compelled to get all his information from agents for the manufacturers. If he is anxious for the truth to enable him to select the machine best adapted to the requirements of his town, he can learn all that he need wish to know as to weights, performances and other details from sources entirely disinterested and reliable.

Considering the service to be performed by automobile apparatus in a small town, and particularly the condition of the streets in unfavorable seasons, the machines must be practically as strong and powerful as those for city departments, and anything that purports to be "light and inexpensive" for village use is a delusion and a snare if it is expected to carry the same weight of hose or implements that is loaded on the extremely well built machine used in a large city. A thousand feet of hose weighs as much in a little town as in Chicago and it is just as necessary to get it to the fire without breaking down on the road. If some small county seat finds it has the money to buy a motor machine for its fire department, and is satisfied that the streets will permit it to be used all through the year, the best plan for the officials to follow is to buy just the kind of apparatus, manufacture, style and weight, that they know to have been a success in the best large city department within reach.

Automobile fire apparatus has been so extensively written about during the past three years at least, and is now coming into such common use, that firemen even in small towns are very fairly posted on it. It does not seem as if anyone need buy in ignorance.

Drills.

No matter what the growth of a volunteer organization, the general principles mentioned at the first hold good, even though the membership increases to several hundred with all kinds of apparatus. There must be a proper interest and enthusiasm on the part of the volunteers and these cannot continue without appreciation, encouragement and support from the town officials and citizens. Paid men can be handled after a fashion, by a prompt payment of salaries and a sort of easy tolerance of their existence; but not volunteers, whether they receive a small sum of money or not. In every respect, except money, they may be said to cost more than men who give their entire time and get no other wages. One of the many instances in which concessions must be made is in allowing such drills and exercises with the apparatus as will keep them proficient, and this suggests a bit of advice to the Chief. Drills are absolutely necessary and they should be so arranged as to make every volunteer familiar with the work, but it is best not to overdo them. Spasmodic enthusiasm is of little value; there is nothing gained by starting out with drills that are so strenuous and take up so much time that the members are soon tired of the whole affair. This has happened in the history of many departments, and it is a serious mistake. Such exercises ought to be entirely practical and full of lively work from start to finish; there should be as many participating as possible and care is to be taken that they will be likely to come again without too much urging. Frequent short drills are better than occasional ones lasting too long. Each should be calculated to bring out some different action, unlike the one before; this will prevent their becoming too monotonous.

Quarters.

Another matter requiring the co-operation of authorities and citizens is that of the assembly room. The firemen must have a suitable place for their meetings. If this may be combined with something in the nature of a club room it is very desirable. Many of the most successful volunteer departments owe their efficiency largely to the fact that they were given comfortable assembly and reading rooms, and also some gymnasium equipment. These are worth a great deal to such organizations, affording the members much enjoyment when together. Probably nothing does more than this to keep up the interest that is so vitally necessary.

Hose Races.

There is often much friction between the authorities and the firemen over hose races and tournaments. It may be said that these are very valuable to volunteers, and as practice drills alone are good things for the town officials to encourage. But they should not be overdone; they ought not to run into anything not practical in the fire service, nor should they be participated in by those who are not bona fide firemen. There is great danger that the enthusiasm for winning prizes be carried too far;

that men be taken into the companies who are only wanted as sprinters, and that the real working firemen be kept in the background until they are disgusted and quit. The first duty of a fire company is to put out fires, and this must never be lost sight of. If the actual fire fighters are good runners, couplers and ladder climbers, they are to be patted on the back and encouraged; any town may well be proud of them. But they are too valuable to be demoralized by losing a race with a lot of professional sprinters who have been taken into a company only to evade the rules.

Changing to Paid System.

Indifference and neglect of volunteers have often forced a town board or council to establish a so-called paid fire department, when a fairer treatment would have kept the old firemen efficient for many years longer. Many a time when we hear that the volunteers are "played out" and "no good any more," the truth is that they gave excellent service until their *morale* was spoiled by the negligence, or even passive hostility, of those who should have been anxious to encourage them. If even an imitation paid system was established at once it would not be so serious, but it is often the case that a town goes through a sort of transition period, during which the volunteers are criticised and even ridiculed, and yet nothing is done to replace them with others. Considering that a reliable paid system is a very expensive affair, and that few of the departments that are ridiculously undermanned, and only called "paid" by courtesy, are able to fight an unusually dangerous fire, this policy cannot be defended from any point of view.

Many a town has done away with its volunteers apparently for no other reason than to be able to boast of a "paid" system; a worthy enough sentiment when the former are clearly outgrown and there are resources enough to warrant the cost of fully paid men—and enough of them to put out such fires as are likely to occur. But the majority of the smaller towns, at least, must still depend upon the volunteer, and, under the right circumstances, he can give all reasonable protection. Because this subject is such an important one, outside of the cities, it should have a great deal more consideration than it usually receives.

Dust Explosions and Static Electricity in Mills and Elevators.

One of our Galveston, Texas, members, Mr. Charles R. Brown, has recently interested himself in the hazards of static electricity in the belt-driven machinery of mills and elevators. After a practical local demonstration of the presence of this hazard he succeeded in getting the machinery of the big elevators "A" and "B" of the Galveston Wharf Company, effectively "grounded," eliminating as far as possible from these valuable properties this potential hazard. Mr. Brown's interest in this subject was stimulated by a dust explosion which occurred in the "Sunset" elevator in Galveston last spring.

This elevator had a capacity of 1,000,000 bushels. It was the usual old style frame construction. The machinery was all driven by electric motors. Its reputation for cleanliness was good. This explosion was considered a "mystery." It was investigated by Mr. H. W. Hildebrand, a mechanical engineer, President of the Anchor Milling Co. His conclusion was that the explosion was the result of static electricity. At that time an effort was made to get the machinery in all the Galveston elevators "grounded," and an especial effort was made to have that of the "Sunset" so treated, but without success.

On November 17th this elevator was completely destroyed by fire. An investigation into the cause of the fire indicated that for the second time the cause was static electricity.

Mr. Brown has sent us a copy of the statement of Mr. Hildebrand respecting this fire, in which there was involved insurance to the amount of $1,531,750 on the grain alone. The insurance on the building is not indicated, as it was not insured by companies doing business in Texas.

Mr. Hildebrand's statement is in part as follows:—

In the summer of 1912 we had installed at our mill new machines, which were particularly great dust producers. On making the final test we had, on two different days, two minor explosions on these machines. I myself witnessed the explosions. I knew that no substance had been introduced into these machines that could possibly be the cause. It then struck my mind that there must be some static electricity present, to ignite the dust. I had both of these machines electrically "grounded," which did the business, as we have not had any explosion since—two years and a half—and I have also had all our machines of every kind "grounded."

In all running belts, as every one in the business knows, there is considerable static electricity present. Friction is the origin of static electricity, and the more

the friction the greater the amount of static electricity produced. In the case of a running belt the slip of the belt on the pulley is the particular source. The machine I mention has a rotating shaft with four sets of hammers attached on the inside. This shaft has a pulley 20 inches in diameter and a 14-inch face, by means of which it is rotated at a speed of 1,000 revolutions per minute. The work performed by this machine is intermittent, and, whenever the material is introduced into it suddenly, the shaft is subject to a consequent slip of the belt, which may occur as often as every ten or fifteen seconds.

In making the investigation at the Southern Pacific Elevator I found that they had a pulley 72 inches in diameter by 24 inches in width in each elevator head. Over this pulley the bucket belt ran. The pulley being of iron was faced with a rubber blanket, which blanket was riveted through the face of the pulley with numerous rivets. These two surfaces, that of the rubber blanket and the belt, present a most ideal condition for generating static electricity, and based upon the theory above set forth, the electricity thus generated would charge the pulley, the shaft and the bearings as well.

The facts show that the explosion started at the elevator head, where it was just strong enough to lift the cover off the manhole on top of the scale, but when it got to the bins it was so intense that it tore the flooring over the bins and forced the walls out.

There is no doubt, in my mind, that this explosion was caused by static electricity, and I daresay the recent destruction of the elevator had the same cause.

The issue of the *Grain Dealers' Journal* of March 25th has much helpful matter on fire protection, but in none of the articles is the matter of frictional electricity referred to. The hazard of direct heat from the friction of belts is definitely touched upon, and elevator men are warned of the dangers of grain dust, but the large percentage of fires from "unknown" causes is not even speculatively explained.

Our member Mr. William Reed, Secretary of the Mutual Fire Prevention Bureau, the inspection organization of the Millers' insurance companies, was shown the above statement respecting the probable cause of the "Sunset" elevator fire. Mr. Reed said:—

What Mr. Hildebrand says concerning static electricity is true. I have had, in my experience in operating flour mills, a great many demonstrations of this surprising presence, and flashes under rolls from static electricity when the door was opened and the hand put in to feel of the grinding.

Quite recently, when I visited a large mill, the owner was laboring with me to lower his rate because of the absence of fire hazards. The plant was quite clean, but just before the proprietor and myself went into the engine room, one of the employees had undertaken to wipe up some oil drippings with a rag saturated with gasoline. When he saw us coming he threw the rag down about eighteen inches from where the belt passed through the floor. The fumes of the gasoline were liberated, and when he went back to pick up the rag, the static electricity discharged from the belt to his hand, ignited the gasoline, and set the rag on fire and came near setting the man on fire. We have, for a long time, been working on the problem of grounding machinery, but with very little success, as we were unable to get the unqualified support of the electricians, not only of those we employ, but of the authorities on the subject. Personally I am quite in sympathy with Mr. Hildebrand's conclusions, and am glad to have Mr. Brown and the N. F. P. A. started on the same line of work, as I am sure it will lend force to the effort to remove the hazard from this cause. Our field men have been requesting removal of the static hazard for some time. We, however, do not feel that this is the full solution to the dust explosion problem in flour mills and elevators. We feel that competent help, or in other words, that *until some of the old stick-in-the*

mud millers are "grounded," we are not going to have much relief from our present high loss ratio on flour mills and grain elevators.

Mr. Reed is undoubtedly right that a cheap class of help contributes materially to fires of the "cause unknown" variety; but the figures respecting such fires are sufficiently impressive to warrant a careful investigation by millers and elevator men throughout the country of the hazards Mr. Brown is attempting to eliminate in Texas.

The statistics of the Grain Dealers Fire Ins. Co., which cover an experience of twelve years, show that of its 538 losses during those years, 59 were credited to friction and 61 to "unknown" causes.

During the years 1910-11-12 and 13, ten of the Mutual companies specializing in flour mills and grain elevators paid losses on 374 elevators. Of these fires 116 were credited to "unknown" causes, and 21 were credited to elevator head or boot. The total losses paid on elevators during these four years by these ten companies, aggregated $2,565,000; the losses paid on elevators for fires credited to "unknown" causes amounted to $465,000. The experience of the Millers National and of the ten Mutual companies shows that over one third of the fires are due to "unknown" causes, and most of these fires start within the building.

Department of Fire Record.

GENERAL FIRE RECORD.

Unsatisfactory or Serious Fires in Buildings Equipped with Sprinklers.

Where sprinklers fail the cause is, almost invariably, clear. These fires are selected to indicate such causes, that they may be generally understood and satisfactorily met.

S-17259. This fire occurred in the vault of a six-story fireproof building occupied as a wholesale drug warehouse with manufacturing.

Construction. Reinforced concrete, 3½-inch concrete floor slab with two by three-inch wooden sleepers, eighteen-inch centers filled between with cinders and double flooring laid on top. Property fronted on three streets, the windows being of wooden sash and ordinary glass. The building was divided into two fire sections, 105 by 75 and 105 by 40 feet, with stair tower and passenger and freight elevator shafts common to both sections. The stair was brick enclosed and cut off at each floor by kalamein fire doors with wired glass windows in them. There was no direct communication from the passenger elevator to the two sections, but openings on each floor to the stair tower were unprotected. The freight elevator shaft adjoined the passenger elevator and was cut off from it by an eight-inch brick wall except at the roof line where there was a four-inch tile partition with an unprotected opening three by three feet at the top of the elevator. There was a large wired glass skylight over both the stair tower and the passenger elevator shaft. The freight elevator was enclosed in an eight-inch brick wall supported at each floor level by the concrete frame of the building, and partly over this was the 20,000-gallon gravity sprinkler tank enclosed in a tower approximately twenty feet square and forty feet high. The tank tower above the roof line was constructed with a four-inch brick wall with four-inch hollow tile backing. The freight elevator shaft opened into each fire section at each floor level, the openings being five feet four inches wide by seven feet high and protected by two-inch wood, tin-clad fire doors divided into two

equal upper and lower sections and sliding vertically on an angle iron frame inside of shaft, the doors being slightly wider than the opening. On the second floor (office section) on the east side, in addition to the fire doors there were wooden panel doors.

Construction of Vault. The vault containing the material that exploded was in the basement of the east section and adjoining the freight elevator shaft. This vault was ten feet long by eight feet wide by eleven feet high, extending into the room beyond the freight elevator shaft. The walls of the vault were brick sixteen inches thick and laid in cement mortar. The only opening was a door three by seven feet at the front end, protected by a good three-inch tin-clad swinging fire door set in a wooden tin-clad rabbeted frame; the hinges of the door were set into the brick wall and bolted to the door. The catch was screwed to the tin-clad wooden door frame. Vault had concrete floor. The vault was located near the center of side of room and was not vented. There was one incandescent light in the vault, wires being run in conduit with controlling switch outside of the vault. The vault was not sprinklered at the time of the fire, but one sprinkler has been installed since.

Contents of Vault. An inventory had been made of the stock in the vault on the day previous which showed that it contained a considerable quantity of hazardous chemicals, among which might be noted the following: Nine 11-pound tins of phosphorus; four 1-pound bottles of phosphorus; one 50-pound case of pyroxyline; six 5-gallon tins of benzole; four 1-pound tins of metallic sodium (kept in naphtha); a large quantity of carbon bisulphide; three 5-pound bottles of picric acid; about 200 tubes containing 50 grams each of ethyl chloride; three 5-pound tins of ten per cent nitro-glycerine solution in alcohol; eleven ¼-ounce bottles of potassium metal; and other equally hazardous chemicals.

Since it was a holiday, the plant was not in operation. It is possible if the whole staff of employees had been present, as on an ordinary day, there might have been loss of life and serious injuries. On holidays watchman's rounds were ordinarily made at 9 a. m., 12 m., and 3 p. m.

Story of Explosion. Watchman's station No. 1 was located in the north end of the basement of the east section, about 40 feet from the vault. The dial showed that this was punched some minutes before noon,—just how much could not be determined. To reach station No. 2, the watchman passed close to the vault, south side of the basement of the west section, and then passed up the main stairs (not going by the vault) to the front end of the first floor of the east section, and the punch for this station was apparently on the line for 12 m., although this could not be determined. The watchman was on his way to No. 4 station at the rear of the first floor and was about 30 feet away from the freight elevator shaft when the first explosion occurred. He was blown to one side and affected by the shock.

The central station of the fire department was located one half block from the plant, and the firemen in the station hearing the explosion rushed into the street and noticed the smoke and vapors coming from the

building. The fire alarm box in the station was pulled at 12.10 p. m., calling out the entire central division of the fire department. When the firemen arrived, they found the building filled with smoke and fumes, there being a strong smell of ether and sulphur. In fact, the engineer in the building across the street stated that the gases and odors were very perceptible in that building. The sprinklers in the basement of the east section of the plant were operating and the flames were pouring out of the vault, the fire door having been blown open by the bending of the stamped steel lug or catch, thus releasing the latch. That the fire in the vault caused intense heat is evidenced by the effect on the brickwork near the bottom of the vault. A flash of fire affected barrels of salts, etc., piled within ten feet of the vault and scorched the tops of these for an area of about twenty by twenty-five feet. This was the only effect of fire outside of the vault, and the sprinklers extinguished it.

As the fire was all in the vault, the fire department started to shut off the sprinkler system and had closed the controlling valve at the city connection when there was a second explosion, not so violent as the first, but the fumes were so bad that the firemen were driven from the basement. With the aid of a smoke helmet one of the salvage corps entered the basement and again opened the city supply to the sprinkler system. As the tank supply, however, had not been shut off, the sprinklers continued to operate; in fact the tank was emptied.

Effect of Explosion. A great many of the windows in the basement and first stories in the east section were broken, as well as on the upper floors, but some windows on the upper floors were broken by the firemen to let the smoke and fumes out of the building. The two by three-inch plank flooring supporting the elevator machinery at the top of the freight elevator shaft was partly forced out of position. The upper halves of the fire doors on the sixth floor at the freight elevator shaft were blown twenty to twenty-five feet into the rooms, and slight damage was done to the eight-inch brick wall of shaft. On the fifth floor of the east section, the elevator doors were bulged but not blown out, and the wall of the shaft bulged slightly. No damage was done in the west section, but plaster was broken off the wall of the passenger elevator shaft. On the fourth floor there was little damage to the freight elevator shaft. On the third floor the upper half of the fire door in the east section was blown twenty-five feet into the room: in the west section the elevator door was bulged slightly. On the second floor of east section the fire doors at freight elevator shaft were blown against the wooden panel doors in front of them, the wooden panel doors being carried some ten feet, striking some wooden filing cabinets about five feet high. The drawers of the cabinet nearest the elevator shaft were forced into and pushed out the drawers of the cabinet opposite to them. In the west section practically no damage was done. On the first floor in the east section the upper half of the fire doors at freight elevator shaft was blown about twenty feet into the room, and a frame and glass partition about thirty feet from the shaft was forced out of position, breaking the glass and striking one sprinkler, which opened.

The glass was also broken in the door of an office partition about thirty feet from the elevator shaft in the opposite direction from the partition named above, and a few bottles containing stock were blown down but not injured. In the west section the fire door at the freight elevator shaft was bulged outward slightly. In the basement of the east section the fire doors at the freight elevator shaft were blown in. As previously noted, the fire doors at the freight elevator shaft were slightly larger than the opening, but the explosion was sufficiently violent to force them even on the sixth floor through the opening and out into the rooms. In a vertical line, the sixth or top floor of the building is some seventy-five feet from the vault. The wooden treads in an iron stairway from basement to first floor of the west section were also blown out.

Apparently no damage was done to the concrete frame of the building, the explosion having vented itself through the windows and through the freight elevator shaft.

Cause of Explosion. This has not been ascertained, but possibly may have been due to the handling of stock the day previous to taking the inventory. Some of the hazardous stock may have been spilled on the floor. It is also not known whether the fire preceded or followed the explosion.

Additional Fires from Contents of Vault. The owners removed some of the contents of the vault likely to cause trouble (such as phosphorus) in the late afternoon of the day of the fire. An interesting feature, however, is that material which had been spilled on the floor, either in the vault or directly outside, continued to take fire for some three days after, probably to a great extent from friction when it was stepped on. A fire also started in a barrel of boracic acid some thirty feet from the vault, and there was a fire in the contents of another barrel in the west section. Probably these fires were due to some material from the vault which had been carried or had fallen into the barrels. None of these fires amounted to anything, being carefully watched and extinguished.

Loss. The loss was approximately $3,000 on building and from $6,000 to $8,000 on contents. The damage to windows broken in adjoining buildings amounted to $300 to $400.

S-16713. Mercerizing building had brick walls and plank and timber roof and second floor, with concrete first and basement floors, and had been completed about a year. It was used in the first floor for mercerizing and in the second or upper floor for singeing and storage of grey goods. A gas singeing machine was used, supplied by city gas, the cloth passing through in the usual manner. At the delivery end of this machine was a trough in which there was run a set of three rubber rollers with the lower roller partially submerged. This trough contained a 3 per cent solution of a mordant oil and water. It was filled through a temporary pipe connection from a mixing tank holding 200 to 300 gallons, nearby on a table. A permanent direct pumping apparatus for filling the trough was not quite finished. The cloth passed from the machine through the

rubber rollers, which served the double purpose of extinguishing any sparks and simultaneously saturating the cloth with the solution which prepared it for the mercerizing process. From the singeing machine the cloth passed to the mercerizing machine on the floor below through a wooden chute open at the upper end, with the lower end terminating in a U-shaped section with its lower side composed of rollers with spaces for ventilation and drainage between. There was a certain amount of the wet cloth normally always at the bottom for the purpose of aging, as the process was designed to be continuous. This wet cloth acted as a seal for the bottom of the chute, preventing draft upward through the roller bottom.

This was the first day that the singeing machine had been in operation, and a test run was underway. Some difficulty was met in the adjustment of the gas flame, and while the attendants were working at this end of the machine the liquid in the trough became lowered until the cloth ran dry without it being noticed. Consequently dry cloth was being delivered into the chute, and it was undoubtedly from a spark in this dry cloth that the fire originated.

As soon as the flame was noticed coming from the top of the chute, the men attempted to extinguish it with pails of water from the mixing tank, but as it rapidly gained headway, they were driven away. As they were driven back they reported that the sprinklers were operating and water being delivered from them.

The sides of the chute were practically tight, excepting for a vertical crack between two of the planks which was left for access to the cloth for testing the temperatures. This opening had the effect of converting the chute into a flue when the fire started, and the flames quickly reached the ceiling in the top story and spread rapidly along the ceiling. Windows along the south and east corner on this floor were opened for ventilating purposes, and as the wind was blowing with considerable strength on this side, it resulted in carrying the great amount of heat throughout the room, opening 318 sprinklers. Although there was a sprinkler directly over the opening to the chute, the proper distribution from this head was almost entirely prevented by the timber used for supporting the shafting and reel over which the cloth passed.

Employees put on four hose streams from the yard hydrants. The giving of the public alarm resulted in the applying of the special fire pressure to the street main which was supplied from public water. The fire pump was also started about this time and run for about an hour and a half. Because the sprinkler feed to this building was connected to the city connection outside the check, rather than to the yard system, the fire pump pressure was checked from the sprinklers. Since the by-pass valve around the check was not opened, the pump pressure was not available on the sprinkler equipment, and this resulted in the entire sprinkler equipment receiving a poor supply.

The fire was finally extinguished principally by the hose streams after about two hours of hard fighting. Of the two men working at the

singe machine at the start of the fire, one was overcome by smoke and suffocated.

A section of the floor under the singe machine was concrete construction and the entire floor under the mercerizing room was of concrete. There was comparatively no leakage through these floors, but considerable water ran through the plank and timber floor under the cloth storage, and some goods were wet in the mercerizing room.

S-16851. This fire took place in a pyroxylin plastic factory manufacturing hair pins, etc. Fire was discovered about 12.10 p. m., in south side of first floor, by employees who were eating their dinner. Fire spread so suddenly, followed by an explosion which blew out three windows, that three of the employees were badly burned about the neck and arms. Cause of the fire is unknown. The processes on this side of the room consisted of cutting cold, round and flat stock.

A peculiar feature of the fire was the manner in which it spread, as there was no appreciable sign of fire between burned places. Forty-eight sprinklers opened and practically extinguished the fire.

H-10846. Building was of steel skeleton construction with partitions of three-inch gypsum block, steel work protected with mortar plaster on wire lath on flanges of beams and girders, and columns protected by two-inch gypsum block, iron stairs open to halls of gypsum block, part with sub-standard metal-covered panel doors with upper panels of wired glass and part with wood panel doors with upper panels of thin glass; also thin glass sidelights in wood sash and frames to floors.

The building was occupied by various film concerns storing films in single wall metal cabinets and some of these films were not kept in individual metal cans.

Building exposed as follows: North, wired glass windows 40 to 50 feet to unprotected windows on rear of dwellings. East, blank wall where adjoining; plant had wired glass windows over roof and five feet across court to unprotected windows on ordinary hotel. South, ordinary unprotected windows on street. West, blank wall where adjoining; plant had wired glass windows over roof, five feet across court to blank wall and five feet diagonally to flat framed iron shutters or wood metal covered doors of theatre. Wired glass windows of property were in hollow metal sash and frames, not labeled or standard but of good construction.

Fire was discovered by an employee who had left the room for a short time and upon returning found the examining table ablaze. Origin of the fire is unknown, but it is supposed that a piece of film came in contact with a small motor on a shelf under the examining table. The examining and rewinding machine was located on a wood metal-covered table (with an electric light, rarely used, under a ¼-inch glass) and obtained power by belt from above mentioned motor located on a shelf under table. Power was thrown on and off by means of a treadle operating a friction clutch. This machine had been in operation just before the employee left the room. A film had broken just before employee was

called away and it is supposed an end of the film came in contact with motor, which was not enclosed.

When the employee returned he found the whole table ablaze and immediately went into the hall and called "fire." An employee from one of the lower floors was the first to turn water from standpipe on fire, taking the hose from the fifth floor. A fireman from the public fire department was stationed in the main hall of this building during working hours and took charge of the hose until the fire department arrived, and the fire was quickly extinguished. It is estimated that between 130 to 150 films were stored in single wall metal cabinets and it is claimed that all but the one under examination were in metal cans. All the films were burned.

The fire was confined to the sixth floor and to one side of loft. The wood trim and wood furniture were badly charred and the finished plaster was down in the storage and handling room, also in office and vacant rooms each side of fire. The finished plaster was partly down and the paint on the woodwork blistered in hall immediately in front of room where fire occurred. Otherwise very little damage was done to sixth floor, except by smoke. The two floors below and one floor above had slight damage by water. The building structure shows no damage and the plaster block on wood frame partition withstood the fire well.

All electrical devices used in connection with operating machinery where films are handled should be properly enclosed. Films should be stored in approved vault of masonry, or if less than 200 films are to be kept, these should be stored in approved double walled cabinets with proper vents to outside of buildings. Buildings where films are stored or handled should be equipped throughout with automatic sprinklers.

S-17289. This fire was in a one and two-story frame building with joist floors and open finish. The building was occupied by a tannery. The fire started just after the factory had shut down for the noon hour. The open shed on the south end of the building was used for the storage of drying frames. Cause of the fire was probably smoking. Sprinklers in this shed were shut off for the winter, and as there were unprotected openings between this shed and the main building fire spread rapidly into the latter.

The employees quickly manned a line of hose from yard hydrants. They stated that there was not water enough to make one good stream. A number of sprinklers opened in the main building. The hydrant was fed from a four-inch pipe which connected with a six-inch pipe about 800 feet from the plant. The automatic sprinklers in both this building and the tannery nearby were fed from a separate six-inch yard pipe.

Fire department was summoned by telephone and after about fifteen minutes arrived and connected two lines of hose to a hydrant about 800 feet distant. These streams were of practically no use, however. A little later a steamer arrived and two fair streams were then available, although the pressure in the mains was so low that the steamer had to

draft instead of taking water under head. The building was destroyed in about an hour, but fire department was able to save the main building.

The static pressure in the mains at this location was 65 to 75 pounds, and it is 3,000 feet to a larger pipe. The water supply was inadequate for either sprinklers or hydrants. At a test made in June, 1914, with two ⅞-inch streams connected to yard hydrants, pressure dropped from 71 static to 27 pounds. A drip valve test made in this building December 15th with two-inch drip valve wide open showed a reduction from 70 to 38 pounds.

Building was equipped last fall with sprinklers supplied through an alarm valve. The contents of the building were very inflammable and there were, undoubtedly, naphtha fumes present.

Loss was practically total.

Points of Interest from Fire Reports.

These notes are intended to illustrate the efficiency or inefficiency of signaling, retardant or extinguishing agencies.

Automatic Sprinklers.

S-17273. When the fire department arrived, fire had been extinguished by sprinklers and the water was still flowing from them. Neither the fire department nor the fire patrol could locate the control valve. They went to the roof and opened the drain valves at pressure tanks, allowing the contents of tanks to discharge on roof. There were two of these tanks with a total capacity of 9,000 gallons, and the water discharged from them could not be carried away by roof drains, so it backed up and worked its way down to the floors below. This resulted in considerable water loss.

S-16945. Fire occurred in a pile of sweepings and was extinguished by water buckets before the arrival of the firemen. Four sprinkler heads had fused, but no water was discharged because of the plugging of the heads in the vicinity with solder, the heads having been removed and filled. Six heads had been tampered with in this manner and six others had been covered with metal cups filled with asbestos. The condition of the heads had been called to the attention of the owner and occupant of building over a month previous to the time of fire but was not remedied, they claimed, because of delayed shipment of new heads from the manufacturer.

S-17203. This fire was of incendiary origin and would have been quite serious except for its prompt discovery by a policeman. The sprinkler alarm had been disconnected and the valve in the pump suction shut off. The firemen found that three sprinklers had been tied up with new asbestos paper wired on. Two of these sprinklers were located over the rack of lasts and one over the bags of leather clippings in which fire started. Two of these heads failed to open. The third one fused in spite of the asbestos covering, although its distribution was poor. The fire was extinguished by the fire department using chemical streams.

S-16977. The oil at a hot bearing in the basement of machine room building became ignited. One sprinkler opened and apparently extinguished the fire. The valve controlling the sprinklers in the building was then closed in order that this head could be replaced, but before this

could be accomplished, fire was noticed in one of the monitors above the machine room. The valve was immediately opened, but this slight delay allowed the fire to gain headway, which probably would not have occurred had water been on the sprinklers at the start. Twelve sprinklers opened and the fire was extinguished by the additional use of two large hose streams.

S-17465. Watchman heard water running and upon investigation found fire in a corner of the foundry near the cupola in a wooden clothes locker. The locker was located under a large motor and blower platform enclosed in corrugated iron. No sprinklers had been installed under this platform and consequently the fire had gained considerable headway before sufficient heat passed through the cracks in the floor to open the sprinklers in the room above the locker. Watchman found all the sprinklers in the blower room operating and water coming through the cracks in the floor, but not in a sufficient amount to extinguish the fire. This was put out by the use of a few pails of water.

The necessity of locating sprinkler heads so that the water may reach every part of the building is clearly emphasized.

S-16818. A workman in a brass foundry placed a cold pot into a batch of melted aluminum, with the result that the molten metal was thrown in all directions. Evidently some of it passed over the brick wall separating the brass foundry from the pattern shop which did not extend all the way to the roof between the joists. The hot metal lodged on the second floor near the eave of the roof, and in a few minutes smoke was discovered by the workman. The loss would have undoubtedly been considerably less had the water from the sprinklers been able to reach the seat of the fire. The somewhat congested condition of the pattern storage, and the fact that the line of sprinklers was too far away from the eaves of the roof, prevented the water from reaching the seat of the fire.

S-16907. Fire is said to have started in a waste can used for rubbing-rags. Can was left in front of elevator to be removed and have contents burned, but had been overlooked. It was an unapproved type with a light cover which was probably left open. The contents of the can ignited shortly after midnight and the heat opened one sprinkler which practically extinguished the fire. The sprinkler alarm operating through central station called out the fire department, which turned the water off, replaced the head and restored sprinkler system to working order.

This is a very good example of the effective work done by a standard sprinkler equipment with central station alarm system.

S-16850. Fire apparently originated in a can containing waste paper which was set on wooden floor. The fire burned downward and opened a sprinkler and also operated a thermostat in the basement. Thermostat transmitted the alarm to the fire department, which found upon its arrival that the fire had been extinguished by the sprinkler.

Automatic Sprinkler Alarms.

S-17052. Engineer heard alarm bell and immediately closed valve at base of riser. After looking around he learned that there was a fire in the building and opened the valve, but not far enough to properly actuate the supervisory circuit. Sprinklers held the fire in check but did not extinguish it, since it was burning under a table. The loss was $27,000, and was due to the contents (stock of lace and embroidery) being very susceptible to smoke and water damage.

Watchman and engineers should be thoroughly instructed as to the operation of sprinkler systems and alarm apparatus. Frequently serious fires develop because someone closes the gate valve before ascertaining if there is a fire.

S-17122. The alarm bell was said to have rung for about fifteen minutes before anyone paid attention to it. It was heard by the watchman and several employees of the property next door, but no attention was given to it until a passing fireman happened to notice water trickling down the side of the building. He immediately notified the fire department. The fire had been practically extinguished by the sprinklers.

S-17087. This fire started during the night in a small enclosure about the band saw. Fire burned out through the enclosure, opening two sprinklers in second story and burned through floor down into a timber, operating one sprinkler in first story. Since there was no alarm system, it is not known how long sprinklers had been operating. Employee arrived at 5 a. m. and saw the water. Sprinklers had evidently been operating a long time, for much water was on the floors of the building and running down the street.

Where there is not a watchman it is imperative that the sprinkler system be provided with some alarm device to prevent such a condition.

S-16603. This fire occurred on a Sunday in a ladies' shirt waist factory. The A. D. T. central station received water flow signal and immediately transmitted alarm to public department. Fire department was obliged to break in the door of the tenant, as there were no keys kept at property for various floors. The fire was found entirely extinguished, one sprinkler having operated.

After the fire a gas-heated pressing iron was found standing on partly burned pressing table, with rubber hose burned off. Apparently some one had been at work doing some pressing early that morning.

S-17009. During the noon lunch hour employees smelled smoke and noticed water dripping in another part of the office. The fire was located in a wooden cabinet containing apparatus and chemicals used in the research laboratory. Two sprinklers operated and had covered the floor to a depth of two or three inches with water. The water could not reach the seat of the fire directly, but held it in check until the city department responded. The water damage to the floors below was considerable

and might have been much less had the system been equipped with an alarm valve which would have notified the employees, who were in the building, soon enough to have prevented such a large water loss.

Sawdust as an Extinguishing Agent.

S-16933. A spark from chimney entered through broken window and dropped into dip tank, igniting the contents. The material in the tank was destroyed and also a small amount of stock. The fire was extinguished by one sprinkler, a small hose stream, and sawdust; the latter proving very effective.

S-16709. A workman had just filled a pail with gasoline and a pail with cement from supply tanks and was carrying them through a narrow space between a pile of tires and a portable electrically-driven drill press. The pail containing the gasoline accidentally struck against an exposed electric switch. There was a spark and the gasoline became ignited. The burning gasoline and cement set fire to several piles of finished tires, damaging about 112 of them. Four sprinklers opened promptly and held the fire in check. Fire brigade immediately responded to the alarm and entirely extinguished the fire with the aid of sawdust. The only damage was to the tires and the insulation on the electric motor.

Miscellaneous.

S-16997. The watchman tried to send in an alarm from the public box in front of the plant, but was unable to do so as he could not open the door. The box had been painted several months previously and had not been opened since. The thick coat of paint held the door closed. Watchman then sent in a telephone call and operated the factory whistle.

H-10446. This fire, which was caused by lightning striking oil tank, was confined to the tank itself. It was fought by the company employees and extinguished in the following manner: When a tank is ignited, the oil is rapidly drawn away by pumping until the boiling or high temperature oil is reached. The remaining or surface oil in the tank is then allowed to burn out. To prevent spread of fire by oil boiling over and reaching other tanks, earthen embankments are thrown up around each burning tank. These embankments are permanent, although extra ones are usually made during a fire.

H-10465. This paper warehouse was two stories in height, constructed of stone and brick. On the first floor were stored about 400 tons of rolls of strawboard paper, just as it came from the mill. The second floor contained about 60 tons of baled waste paper in the east room, while the west room was entirely vacant, as the floor was being rebuilt of concrete. The corrugated box factory, which was located across the railroad tracks, had been in operation regularly, although it was also closed on this Sunday afternoon.

There were two watchmen (one on each side of the railroad tracks) making hourly rounds with approved portable clocks. Fire was discovered by an employee of a nearby plant, and alarm was promptly turned in. The watchman had passed through this building twenty minutes before and there was no evidence of fire at that time. The cause could not be ascertained. When the fire department responded, the fire was well underway and their efforts were confined to saving the exposed buildings, as the heavy smoke made it impossible to enter the warehouse. The fire hydrants had the "Universal" or "Ear" couplings, but the hose had mostly National standard couplings. Fire department used short length adapters and in this fire three of these adapters burst, the coupling being pulled off from the hose. One of the nearby hydrants leaked so badly after a packing ring blew out that it was not used any longer and the hose line had to be connected to a hydrant 750 feet from the fire. One hydrant was fed by a four-inch main from which the pressure was very poor; one by a six-inch dead end main; and three were fed by an eight-inch main. Although there were no recording gauges, the pressure was reported to be very poor during the first thirty minutes of the fire, after which the pumps were speeded up and the pressure increased somewhat. Fire was under control in about five hours, but smoldered for nearly a week.

A heavy stone and brick fire wall on mill side rose one story above mill and stood intact. One opening in this wall on the first floor was protected by double automatic tin-clad fire doors. One door was closed; the other closed automatically, and these doors stood intact although exposed to severe heat.

The importance of uniform thread of couplings and hydrants is clearly emphasized, also the necessity for frequent test and repairing of hydrants.

Fire Causes.

The fires here given are selected to illustrate defects, either of construction or superintendence, in the classes of property indicated.

Gasoline or Other Volatiles.

H-10242. Employee attempted to start an automobile, when the starter short circuited and ignited a pail of gasoline nearby. The fire was extinguished with chemical extinguishers and sand. Damage to the car was slight.

S-16929. An employee was filling a gasoline reservoir on automobile from a portable tank. In withdrawing the filler pipe from the reservoir considerable gasoline was spattered on the upholstery of the automobile, and it is thought that some of it fell upon the rear light which had not been extinguished. The fumes were ignited and flames were communicated to the main body of the automobile. Employees rushed for some carbon tetrachloride extinguishers and poured these onto the fire. Meanwhile the heat fused three sprinkler heads above the automobile and the water from these practically extinguished the fire except in a few small places which it could not reach. Fire department completed the extinguishment with hand chemicals.

S-16628. A man was washing automobile parts in an open pan containing gasoline. A draft blew the vapor over to a bench where vulcanizing was being carried on and it was ignited. Three sprinklers opened and immediately extinguished the fire.

S-16972. Fire occurred in this garage when a gasoline tank on an automobile was being filled from a 48-gallon portable gasoline tank. The engine of the automobile had been stopped while the tank was being filled and probably a back fire of the automobile engine caused the gasoline to ignite and set fire to the portable tank. The blazing portable tank was pushed aside and the burning automobile hauled out of the building to the street, where the fire was extinguished by hand chemical extinguishers. The flames from the portable tank in the meantime had opened five sprinklers in the building. A rope was placed about the portable tank and it was hauled out of the building to the middle of the street, where it exploded a few minutes later. The sprinklers extinguished the fire in the building before the fire department arrived.

H-10439. An automobile owner was cleaning his automobile, using waste moistened with gasoline. A screw driver was dropped onto the engine and apparently fell across the lighting wires or onto the binding posts, causing a short circuit which resulted in a spark. The vapor ignited and the automobile was destroyed before the public department responded.

S-16923. This fire occurred in the compounding building where the transformer coils were dipped in a varnish thinned with naphtha. The dip tanks were 5 feet by 6 feet by 8 feet and contained about 1,220 gallons of varnish at the time of the fire. The tank was constructed of iron with heavy iron cover. An overhead electric crane was used for raising the cover and resting it against the wall. On the day of the fire, after the cover had been opened, the chain of the crane came in contact with some electric wires and caused an electric spark directly over the dip tank, which ignited the fumes. Six sprinkler heads directly above quickly opened and smothered the flames sufficiently to allow the men working in the shop to pull down the cover, which put out the fire.

All dip tanks should be provided with automatic covers and overflow pipes.

S-16978. A customer desired to purchase some denatured alcohol. As he was in a hurry the clerk sent him into the basement to get it himself. The man was not smoking at the time he entered the basement, but started to smoke before attempting to draw the alcohol. The fumes were ignited, but the fire was promptly extinguished by two sprinklers which quickly opened.

There were "No Smoking" signs posted in conspicuous places.

S-17239. Room where fire occurred contained 29 varnish tanks of 1,000 gallons each. One tank was empty and the men who had just finished washing it out with benzine were using a light extension cord and incandescent lamp to work by. Apparently there was a short circuit in the wiring, causing a spark which ignited the benzine fumes. Top of tank was off and a sprinkler almost directly above operated and quickly extinguished the fire.

S-16435. Employee brought in a pail or uncorked can of gasoline. This was set down near an emery wheel which was being used. A spark from the emery wheel ignited the gasoline. Employee endeavored to put out the fire with a pail of water, but this merely served to spread the burning gasoline. Eight 2-gallon chemical extinguishers were used and the fire was extinguished before sufficient heat was generated to open the sprinklers.

Oil Fires.

H-10424. Steel tools were tempered by immersing in a high grade petroleum oil which was kept in an iron kettle of about one barrel capacity. In immersing a hot tool in the oil, the latter took fire. It is

supposed that the metal must have been heated to higher temperature than usual and consequently ignited the oil. This same process has been followed for a long time, but the oil may have been of a different grade.

S-16872. This fire occurred in a plant used for the manufacture of electrical apparatus. Insulation was being tested and the workmen were using a gas grid to heat the oil, when a short circuit occurred or grid became too hot and set fire to the oil. The flames then set fire to oil in a large tank of high-flash oil nearby, which has a capacity of about twenty barrels.

The roof, where this fire occurred, is very high and, consequently, no sprinklers were opened. The private department responded and used fifteen one quart, two 2½-gallon chemical extinguishers, and a 50-gallon chemical engine. The flames were held down, and finally tarpaulins were thrown over the tank and fire extinguished in about half an hour.

Boilers and Fuel.

S-17223. Boiler in this plant is twenty-three years old and of the third return type, double riveted lap joint. In this type of boiler the burning gases, after leaving the fire box, pass back under the boiler, then forward through the tubes, and then up and back again through the third return chamber which is built over the metal shell of boiler with a brick arch roof. About the center of top of boiler a manhole is left for inspection purposes. This manhole is brick and mortar through third return chamber down to the metal shell of boiler. In the course of time this mortar became cracked so that hot gases could find their way out over top of boiler, and it was evidently in this way that first the soot and then the ceiling caught fire.

Sprinklers (286°) operated and held the fire in check but could not extinguish it because of the defect in boiler. Rotary gong operated but electric connection to fire department failed, due to a short circuit with outside light wires, which had only been discovered a very short time before fire broke out. Fire was extinguished by the fire department, which was notified by telephone.

S-16909. Fire started in the boiler room in the coal pile which was banked up against side of the boiler. Between the boiler and the coal pile was a wooden partition made of 1½-inch planks. This partition was intended to protect the brickwork of the boiler from possible damage by the fuel. The heat from the boilers caused this partition to ignite. Two sprinkler heads opened and entirely extinguished the fire.

Electrical.

S-16993. Fire occurred in the cable trench back of switchboard. In this concrete trench were a large number of wires and cables which ran from the various test generators to the different selector boards. At berth No. 6 a transformer was being tested which took exciting current from a 10,500 volt generator and 2,300 volt current from a 3,150 K. V.

A. generator. A violent short circuit took place between the cables in the trench, and the test man immediately opened the circuit breakers at berth No. 6. The arc ignited insulation of the bunched combustible covered cables in the trench and the fire quickly ran along the wires for thirty or forty feet. A small hose stream, together with sand and a chemical extinguisher, were immediately used. Fire department responded and used two large hose streams, while the sprinklers under the roof also assisted in extinguishing the fire. Some of the cables had been covered with asbestos but all of them had not been protected in this way, as it was expected to move part of the testing from this building. Loss $3,000.

S-16610. An electrically heated flatiron used for pressing leather had been left with current on. The iron had been placed on a cutting block, and upon leaving Saturday noon employee neglected to turn current off. On Sunday afternoon the block took fire. Thermostats operated, also one sprinkler, both of these sending in alarm. Fire department arrived and found the fire had been extinguished by the sprinklers. This illustrates the very effective operation of approved sprinklers and alarm system.

Arrangements should be made for opening the circuit to all electric heating devices, such as flatirons, etc., whenever the plant is not in operation.

Water Loss through Leaky Floors.

S-16915. Fire took place in the mule spinning room after the factory had shut down. The sprinklers controlled the fire so well that very little damage was done in the mule room except for the carriage, which was burned. However, four inches of water were discharged on the floor and this leaked through, damaging finished goods in the finishing room below and the clothing of about 35 cards on the first floor. Although the mill help were promptly set to work cleaning up, the resultant loss was from $10,000 to $12,000.

Water-tight floors should be required in all plants where a heavy water loss is possible to the lower floors. The use of scuppers for carrying off the water is recommended.

S-16771. Fire was extinguished by one sprinkler. There was some delay in shutting off the water supply from sprinklers so that a considerable quantity of water was discharged from this one head. It leaked through the floor into the first story where there were in storage 200 cases of raw stock used in the manufacture of lace curtains, handkerchiefs, doilies, etc., also some cased yarn on cops. It is reported that the water stood from one to two inches deep on this floor, and as the cases were not skidded a considerable number of them were wet. Loss $32,000.

S-16690. This fire was probably caused by an overheated fan bearing in slasher bonnet. Four sprinklers opened and held the fire in check until it was extinguished by the use of hose streams. The slasher bonnet and the fan were badly damaged by the fire. The greatest damage,

however, was due to water leaking through the two floors and wetting down the white roving storage on first floor. There were about 60,000 pounds of rovings, 75 per cent of which was more or less stained. Resultant loss was approximately $2,500.

S-16099. This section of the warehouse was of mill construction with floors of two by six-inch plank on edge covered with one and one-half inches of asphalt. There were no scuppers and floors leaked on account of cracks in asphalt and around columns. Fire damage to building was slight, principal damage being to stock, due to water.

S-17302. The floors of this building were provided with scuppers, but they did not operate properly and in some instances were not on a level with the floor. Part of the water from the eighteen sprinkler heads which opened was taken care of by the scuppers, but a considerable amount ran through poor fitting traps to the floor below.

Unprotected Windows.

S-16620. On a dock near this factory was a large pile of old rope and cotton waste. This material became ignited probably from a cigarette or match. There was a strong wind blowing and fire was carried from the pile to the windows of the second floor of main mill. These windows were of ordinary construction and soon gave way. Fire entered second floor, burning considerable stock and the roof joists which gave way, allowing the roof to fall and also putting the sprinkler system out of service. However, the sprinklers were of considerable value in holding the fire in check until the arrival of the fire department.

Metal windows with wired glass would have prevented fire entering the building.

Unprotected Openings.

S-17197. Fire started in the opener picker from unknown cause. Room where this picker was located was well filled with picked stock and the fire flashed rapidly through this. There was an unprotected opening from this room to the lapper room and fire followed stock scattered on the floor to the combination lapper and carder and flashed through this machine. There was a small four by four foot entry between this room and the dry room. Fire followed stock on floor to the dry room and rapidly spread through the stock in it. The dryer was equipped with 286° sprinklers, but none of them opened, as the heat was not sufficient. Nine sprinklers out of twelve opened in the picker room and twenty-eight in the dry room.

Standard automatic fire doors between the picker and lapper rooms, also between lapper and dry rooms would have confined the fire to the place of origin.

Incendiary.

S-17057. This fire was of incendiary origin. The fire broke out under a cutting table and the heat opened three sprinkler heads which

extinguished the fire on the table but could not reach fire underneath. This was extinguished by the firemen with hand chemicals. The firemen noticed that as they walked across the floor there was a crackling sound under the feet. Parts of the flooring which had been damaged were removed to the boiler room, where they were thrown into a pile. They immediately burst into flame. It was then found necessary to remove the entire upper flooring. It is thought that the flooring had been impregnated with an ether or alcohol solution of phosphorus or some similar chemical.

Construction.

H-10195. This large freight pier, having a frontage of 250 feet and a depth of 280 feet, was one story in height and constructed with a wooden two-inch plank roof, supported by steel trusses resting on steel posts. At the time of the fire the material stored therein consisted principally of baled cotton, whiskey, plain paper in bales and some metal goods.

The cause of the fire is not known. There was some delay in giving alarm to the department because the new watchman was not familiar with the location of the alarm boxes. By the time the fire department arrived, the entire interior of the building was ablaze and soon the unprotected metal roof trusses and supports gave way before the heat, letting down the entire roof.

This fire again illustrates the fallacy of using unprotected metal members.

Miscellaneous.

S-16914. This fire, in a plant manufacturing pyroxylin plastic hair ornaments, was caused by an employee throwing an overheated piece of stock into a scrap can. Five sprinklers promptly opened and confined the fire to this can.

H-10457. During a heavy rain storm, lightning struck this residence, considerably damaging the slate roof. At the same time the discharge passed over the electric light service wires, blowing the fuses with such intensity that particles of the mica cap on the block fuses were thrown into an adjoining room. Some nails which secured the porcelain insulators of the insulation were fused, while the entire mechanism of a snap switch was melted into one mass. An inspection of the pole lines showed that the neutral of the three-wire system, from which a two-wire circuit to the building was taken, was grounded but at a point some 300 feet away and in an indirect line from the building.

S-16867. This fire, which started in a belt-box, was evidently caused by the friction of the belt against the woodwork, which ignited the fine dust. The sprinklers held fire in check but were unable to extinguish it on account of the obstruction to distribution. During the fire someone got out an old standpipe hose and turned on the water. This was left running and was the cause of most of the damage, the loss being $300 on the building and nearly $10,000 on the stock.

H-10469. This firm does an extensive business as peanut growers and roasters. Fire occurred on second floor among burlap bags containing shells which had been removed from the nuts after roasting by a rumbling device. The origin of the fire is supposed to have been due to a heating of the burlap bags, which may have been oily and damp. It was quickly extinguished by the fire department.

H-10466. This firm makes medicinal preparations. During the heating of a compound on a small gas stove, a leak in the rubber hose at the connection took fire and ignited hose, which dropped and came in contact with inflammable material near at hand.

Rubber hose connections should be replaced by flexible metal tubing or permanent piping.

S-16899. A large kettle of melted rosins and gums had been removed from the brick furnace to the other side of the room to allow it to cool to a temperature of about 385 degrees, after which a considerable quantity of benzine was poured into the kettle from a two-inch pipe line on the platform. Employee, as was customary, then commenced to stir the contents of the kettle in order to see if the reducer was "taking." In the meantime the fire in the coke oven where the kettle had been heated was supposed to have been extinguished by a small hose line used for that purpose. Evidently the temperature of the melted gums was too high, for the contents of the kettle commenced foaming and the benzine rapidly volatilized, the vapor overflowing the kettle and sinking quickly to the floor. This was followed almost immediately by a severe flash amounting to a small explosion, which severely burned the man who was stirring the kettle and slightly injured the employee standing nearby.

It is said that the flash opened sixteen sprinklers and that the fire followed back, igniting the contents of the kettle. Fire was confined to the kettle, as the sprinklers opened so promptly that the platform at roof above did not ignite. Fire was finally extinguished by the fire department.

The only possible theory as to the cause of the fire was that a spark remained on the bottom of kettle after it had been wet down and this spark caused the vapor to ignite when it overflowed.

S-16626. A bowl of nitric acid used in litho-processes which had been left on a box near partition and work bench upset in some unknown manner, spilling contents against frame bench. Fire was apparently caused by the chemical action of the acid on the wood. Two sprinklers operated and held fire in check until the arrival of the fire department.

Annual Summary.

Statistics of Fires in Properties Having Automatic Sprinkler Protection.

NOTE.—These tabulations are made at the close of each fiscal year, with the object of furnishing a basis upon which the virtue of the automatic sprinkler as an extinguishing agent can be estimated.

Section I is devoted to fires in which the behavior of sprinklers was, for the reasons given, unsatisfactory.

Section II is a statistical record of all reports of sprinkler fires in the files of the Association upon which the information obtained is sufficiently complete for statistical purposes.

In each table the results of the current year ending April 1, 1915, are given, and these are compared to the results of the total eighteen-year record ending at this time.

There have been 1479 fires reported during the year in which automatic sprinklers operated. This is the largest number ever received during any one year and it is a gratifying increase. It is hoped that the Association may continue to receive reports on a large percentage of the fires in sprinklered properties, for it is impossible to arrive at accurate conclusions unless the records for each classification embrace a considerable number of fires.

The results from automatic sprinklers do not vary greatly from year to year. The unsatisfactory fires continue for the most part to be caused by a lack of supervision of the sprinkler system. This year 3.72 per cent are classed as unsatisfactory, which value represents practically no change from that of 3.62 per cent reported last year. The most interesting information may be obtained by examining Table No. 9 and comparing the percentages of unsatisfactory fires in the different classes of property. For example, sprinklered paper mills, tanneries and grain elevators have over 10 per cent of their fires reported as unsatisfactory, while cotton mills have only 1.1 per cent.

The number of heads opening is given in Table No. 5 and continues to show that approximately one third of the fires cause only one head to operate, while over four fifths of all fires do not open more than ten heads.

The data on efficiency of alarm systems is of especial interest and emphasizes the many instances in which the watchman fails to discover the fire, especially when the sprinkler system is provided with an alarm device. In more than one half of such instances he is either notified by the sprinkler alarm or does not learn of the fire until help has been summoned by the alarm.

SECTION I.

Summary of Unsatisfactory Sprinkler Fires.

	1914-1915. No. of Fires.	Per Cent.	1897-1915 No. of Fires.	Per Cent.
Water shut off sprinklers	20	36.4	193	25.3
Generally defective equipment	5	9.1		
Unsprinklered portions	2	3.6	178	23.3
Defective heads	5	9.1		
Defective water supply or supplies	1	1.8	77	10.1
Sprinkler system crippled due to freezing	..	..	18	2.4
Slow operation of dry system or defective dry valve	3	5.5	18	2.4
Slow or defective operation of high test heads	..	..	13	1.7
Faulty building construction, concealed spaces, vertical openings, etc.	2	3.6	36	4.7
Obstruction to distribution	8	14.5	43	5.6
Hazard of occupancy too severe for average sprinkler equipment	1	1.8	37	4.9
Explosion crippled sprinkler system	3	5.5	31	4.1
Exposure or conflagration	1	1.8	62	8.1
Miscellaneous	3	5.5	28	3.7
Plugged heads	..	..		
Not classified	1	1.8	28	3.7
Total	55		762	

Special Classification of Fires in which Failure was Due to Water Being Shut Off Sprinklers.

	1914-1915. No. of Fires.	1897-1915 Inc. No. of Fires.
Water shut off for unknown reason, neglect or carelessness	8	78
Water shut off before fire was out or fire rekindled	2	30
Water shut off due to accidents or repairs	1	31
Water shut off to prevent freezing	6	33
Water shut off, probably incendiary	1	10
Water shut off, leaky dry system	..	3
Water shut off, miscellaneous	2	6
Water shut off, defective gate valve	..	2
Total	20	193

SECTION II.

Annual Revision of Sprinkler Fire Tables.

In the following ten tables is given a summary of fires occurring in properties equipped with automatic sprinklers. The total number of such fires reported during the year was 1974, which includes 495 fires where no sprinklers were opened. Several reports were also received in which the data was incomplete, and these were not used in this summary.

Table No. 1.

Time of Day.

	No. of Fires. 1914–1915.	No. of Fires. 1897–1915 Inc.	Per cent of No. with Data Given. 1914–1915.	Per cent of No. with Data Given. 1897–1915 Inc.
6 a. m. to 6 p. m.	812	8259	55.4	58.7
6 p. m. to 6 a. m.	657	5800	44.6	41.3
Total with data given	1472	14059		
No data	7	310		
Total	1479	14369		

Table No. 2.

How Discovered.

	No. of Fires. 1914–1915.	No. of Fires. 1897–1915 Inc.	Per cent of No. with Data Given. 1914–1915.	Per cent of No. with Data Given. 1897–1915 Inc.
Employee	761	8430	51.8	60.5
Watchman	236	2172	16.0	15.5
Sprinkler Alarm	313	1976	21.3	14.2
Outsider	86	736	5.8	5.3
Thermostats	41	509	2.8	3.6
Automatic Pump	..	10	..	.07
Supervisory System	34	113	2.3	.83
Total with data given	1471	13946		
No data	8	423		
Total	1479	14369		

Table No. 3.

Efficiency of Alarm Service, 1914-1915.

	Satisfactory. No. of Fires.	Satisfactory. Per Cent.	Failure. No. of Fires.	Failure. Per Cent.	Total.
Watchman alone	155	86.1	25	13.9	180
Sprinkler alarm alone	172	97.2	5	2.8	177
Thermostats alone	3	33.3	2	66.7	5
Supervisory system alone	7	100.0	..	..	7

	Watchman.		Sprinkler Alarm.		Thermostat.		Supervisory.		Total.
	Satisfactory.	Failure.	Satisfactory.	Failure.	Satisfactory.	Failure.	Satisfactory.	Failure.	
Watchman and Sprinkler Alarm	87	96*	166	17	..	..	..	..	183
Watchman and Thermostats	1	..	..	..	1	..	..	..	1
Sprinkler Alarm and Thermostats	..	..	35	..	29	6	..	..	35
Watchman, Sprinkler Alarm and Thermostats	..	2*	2	..	2	..	..	..	2
Sprinkler Alarm and Supervisory	..	..	38	1	..	..	38	1	39
Watchman and Supervisory	..	4*	..	..	..	..	4	..	4
Watchman, Sprinkler Alarm and Supervisory	10	19*	29	..	..	..	28	1	29
Sprinkler Alarm, Thermostats and Supervisory	..	..	8	..	7	1	8	..	8

Efficiency of Alarm Service, 1897-1915, Inclusive.

	Satisfactory.		Failure.		Total.
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	
Watchman alone	1255	89.8	143	10.2	1398
Sprinkler alarm alone	1296	92.8	94	7.2	1390
Thermostats alone	157	78.5	43	21.5	200

	Watchman.		Sprinkler Alarm.		Thermostat.		Supervisory.		Total.
	Satisfactory.	Failure.	Satisfactory.	Failure.	Satisfactory.	Failure.	Satisfactory.	Failure.	
Watchman and Sprinkler Alarm	931	550*	1300	181	..	..	..	..	1481
Watchman and Thermostats	13	5*	..	..	17	1	..	..	18
Sprinkler Alarm and Thermostats	..	..	408	30	334	104	..	..	438
Watchman, Sprinkler Alarm and Thermostats	34	53*	80	7	67	20	..	..	87
Watchman and Supervisory	2	4*	..	..	..	..	6	..	6
Sprinkler Alarm and Supervisory	..	..	116	4	..	..	116	4	120
Watchman, Sprinkler Alarm and Supervisory	39	45*	84	..	..	..	83	1	84
Sprinkler Alarm, Thermostats and Supervisory	..	..	21	..	17	4	21	..	21

*These include fires where sprinkler alarm or thermostats notified the watchman.

Note.— These tables do not include fires where alarm service does or does not operate promptly if fire is at once discovered by employee, the alarm service having no bearing on such fires one way or the other.

Table No. 4.

Number of Sprinklers Operating.

No. of Sprinklers Operating	No. of Fires, 1914-1915.	No. of Fires, 1897-1915 In	Per Cent. of Whole, 1914-1915.	Per Cent. of Whole, 1897-1915 Inc.
1	490	4864	34.0	30.7
2	261	2571	18.1	16.3
3	149	1612	10.3	10.2
4	114	1176	7.9	7.4
5	70	758	4.8	4.8
6	57	646	3.9	4.1
7	29	419	2.8	2.7
8	27	410	1.9	2.6
9	21	274	1.4	1.7
10	18	251	1.2	1.6
11	14	214	0.9	1.4
12	17	229	1.1	1.5
13	18	133	1.2	0.8
14	11	155	0.7	1.0
15	11	124	0.7	0.8
16 to 20	42	431	2.9	2.7
21 to 25	20	278	1.4	1.8
26 to 30	13	198	0.9	1.3
31 to 35	11	118	0.7	0.7
36 to 40	4	96	0.3	0.6
41 to 50	12	143	0.8	0.9
51 to 75	13	195	0.9	1.2
76 to 100	5	94	0.3	0.6
Over 100	14	405	0.9	2.6
Total with data given	1441	15794		
Water shut off sprinklers	23	159		
No data	15	240		
Total	1479	16193		

Table No. 5.

Number of Sprinklers Operating.

No. of Sprinklers Operating	No. of Fires. 1897-1915 Inc.	Per Cent. of Whole 1897-1915 Inc.
1	4864	30.7
2 or less	7435	47.0
3 or less	9047	57.2
4 or less	10223	64.6
5 or less	10981	69.4
6 or less	11627	73.5
7 or less	12048	76.2
8 or less	12456	78.8
9 or less	12730	80.5
10 or less	12981	82.1
11 or less	13195	83.5
12 or less	13424	85.0

Table No. 5—Continued.

Number of Sprinklers Operating.

No. of Sprinklers Operating	No. of Fires, 1897-1915 Inc.	Per Cent. of Whole 1897-1915 Inc.
13 or less	13559	85.8
14 or less	13712	86.8
15 or less	13836	87.6
20 or less	14267	90.3
25 or less	14545	92.1
30 or less	14743	93.4
35 or less	14861	94.1
40 or less	14957	94.7
50 or less	15100	95.6
75 or less	15295	96.8
100 or less	15389	97.4
Over 100	405	2.6
Total with data given	15794	
Water shut off sprinklers	159	
No data	240	
Total	16193	

Table No. 6.

Sprinklers Opened on Wet or Dry Systems.

	No. of Fires, 1914-1915.	No. of Fires, 1897-1915 Inc.	Per Cent. of No. with Data Given, 1914-1915.	Per Cent. of No. with Data Given, 1897-1915 Inc.
Wet system	1168	11190	80.3	80.3
Dry system	287	2744	19.7	19.7
Total with data given	1455	13934		
Water shut off system	23	159		
No data	1	276		
Total	1479	14369		

Table No. 7.

Primary Water Supplies to Sprinklers Opened.

	No. of Fires, 1914-1915.	No. of Fires, 1897-1915 Inc.	Per Cent. of No. with Data Given, 1914-1915.	Per Cent. of No. with Data Given, 1897-1915 Inc.
Water Works	800	7102	55.0	51.0
Gravity Tank	324	3926	22.3	28.23
Pressure Tank	260	2101	17.9	15.10
Automatic Steam Pump	70	782	4.8	5.62
Automatic Electric Pump	..	4	..	.029
Steamer Connection	..	3	..	.021
Total with data given	1454	13918		
Water shut off system	23	159		
No data	2	302		
Total	1479	14379		

Table No. 8.

Effect of Sprinklers.

	No. of Fires. 1914-1915.	No. of Fires. 1897-1915 Inc.	Per Cent. of No. with Data Given. 1914-1915.	Per Cent. of No. with Data Given. 1897-1915 Inc.
Practically or entirely extinguished fire	1083	10326	73.21	63.76
Held fire in check	341	5105	23.07	31.52
Total successful	1424	15431	96.28	95.28
Unsatisfactory	55	762	3.72	4.72
Total	1479	16193		

Table No. 9.

Showing Effect of Sprinklers by Class of Occupancy.

	Extinguished Fire.		Held Fire in Check		Total Satisfactory.		Unsatisfactory.		Total No. of Fires
	No.	%	No.	%	No.	%	No.	%	
Agricultural Implements	39	60.0	23	35.4	62	95.4	3	4.6	65
Automobile and Bicycle Factories	45	61.7	25	34.3	70	96.0	3	4.0	73
Awning Factories	3	100.0	..	..	3	100.0	..	..	3
Bag Factories	3	60.0	2	40.0	5	100.0	..	..	5
Bakeries	23	63.8	11	30.5	34	94.3	2	5.7	36
Basket Factories	7	100.0	..	..	7	100.0	..	..	7
Bolt, Nut and Screw Works	10	83.3	2	16.7	12	100.0	..	..	12
Boot and Shoe Shops	347	75.2	98	21.2	445	96.4	17	3.6	462
Bottling Works	3	100.0	..	..	3	100.0	..	..	3
Braiding Mills	4	80.0	1	20.0	5	100.0	..	..	5
Breweries	3	75.0		25.0	4	100.0	..	..	4
Broom Factories	6	54.6	3	27.3	9	81.9	2	18.1	11
Brush Factories	8	80.0	2	20.0	10	100.0	..	..	10
Button Manufactories	8	88.9	1	11.1	9	100.0	..	..	9
Candle Factories	4	66.7	2	33.3	6	100.0	..	..	6
Candy Factories	40	71.4	15	26.8	55	98.2	1	1.8	56
Canning Works	6	66.7	2	22.2	8	88.9	1	11.1	9
Car Houses	16	43.2	16	43.2	32	86.4	5	13.6	37
Car Works	48	66.7	22	30.5	70	97.2	2	2.8	72
Carpet Mills	99	57.8	63	36.8	162	94.6	9	5.4	171
Carriage Factories	73	65.8	31	27.9	104	93.7	7	6 3	111
Celluloid (Pyroxylin Plastic)	68	64.8	22	20.9	90	85.7	15	14.3	105
Cement and Plaster Works	2	66.7	..	..	2	66.7	1	33.3	3
Cereal Mills	20	62.5	8	25.0	28	87.5	4	12.5	32
Chemical and White Lead	31	57.4	21	38.9	52	96.3	2	3.7	54
Clothing Factories	273	78.3	71	20.3	344	98.6	5	1.4	349
Coffee and Spice Mills	30	69.8	13	30.2	43	100.0	..	..	43
Coffin Factories	25	78.2	6	18.7	31	96.9	1	3.1	32
Cold Storage Plants	2	50.0	2	50.0	4	100.0	..	..	4
Cooperage Plants	40	54.8	25	34.3	65	89.1	8	10.9	73
Cordage Works	168	66.7	75	29.7	243	96.4	9	3.6	252
Cork Factories	4	44.4	3	33.3	7	77.7	2	22.3	9
Corset Factories	2	40.0	2	40.0	4	80.0	1	20.0	5
Cotton Ginnery	10	66.7	5	33.3	15	100.0	..	..	15
Cotton Mills	2657	59.8	1734	39.1	4391	98 9	49	1.1	4440
Cotton Warehouses	78	42.6	86	47.0	164	89.6	19	10.4	183
Cotton Seed Oil Mills	33	51.6	21	32.8	54	84.4	10	15.6	64
Cutlery and Hardware	5	50.0	4	40.0	9	90.0	1	10.0	10
Department Stores	236	79.4	50	16.8	286	96.2	11	3.8	297

	Extinguished Fire.		Held Fire in Check.		Total Satisfactory.		Unsatisfactory.		Total No. of Fires.
	No.	%	No.	%	No.	%	No.	%	
Distilleries	6	75.0	2	25.0	8	100	..	..	8
Drug Houses	93	79.4	20	17.1	113	96.5	4	3.5	117
Dry Cleaning Establishments	2	66.7	1	33.3	3	100.0	..	..	3
Dyeing and Bleaching	73	45.6	78	48.7	151	94.3	9	5.7	160
Electrical Appliances	80	76.2	22	20.9	102	97.1	3	2.9	105
Electric Light and Power Plants	2	40.0	2	40.0	4	80.0	1	20.0	5
Elevators, Grain	17	36.2	16	34.0	33	70.2	14	29.8	47
Excelsior Factories	15	83.3	2	11.1	17	94.4	1	5.6	18
Fertilizer Plants	13	59.2	7	31.8	20	91.0	2	9.0	22
Flax and Linen Mills	12	38.7	19	61.3	31	100.0	..	..	31
Flour and Grist Mills	32	51.7	24	38.7	56	90.4	6	9.6	62
Forge and Smithy	9	75.0	3	25.0	12	100.0	..	..	12
Foundries	75	51.7	63	43.4	138	95.1	7	4.9	145
Furniture Factories	307	64.9	124	26.2	431	91.1	42	8.9	473
Garages	22	59.5	14	37.9	36	97.4	1	2.6	37
Garbage Reduction Plants	2	50.0	1	25.0	3	75.0	1	25.0	4
Gas Plants	2	100.0	..	..	2	100.0	..	..	2
Glass Works	27	61.3	13	29.5	40	90.8	4	9.2	44
Glove Factories	6	85.7	1	14.3	7	100.0	..	..	7
Glue Factories	2	40.0	1	20.0	3	60.0	2	40.0	5
Harness and Fancy Leather	37	80.5	9	19.5	46	100.0	..	..	46
Hat, Fur	29	65.9	10	22.7	39	88.6	5	11.4	44
Hat, Straw	5	45.4	6	54.6	11	100.0	..	..	11
Hatters Fur Manufacturing	5	55.6	4	44.4	9	100.0	..	..	9
Ice Plants	1	100.0	..	..	1	100.0	..	..	1
Incandescent Lamp Factories	9	69.2	4	30.8	13	100.0	..	..	13
Insulated Wire Factories	20	64.5	11	35.5	31	100.0	..	..	31
Jewelry Shops	75	86.2	8	9.2	83	95.4	4	4.6	87
Junk Shops	4	80.0	1	20.0	5	100.0	..	..	5
Knitting Mills, Cop Yarn	33	57.9	19	33.3	52	91.2	5	8.8	57
Knitting Mills, Full Process	350	64.3	173	31.7	523	96.0	22	4.0	545
Laundries	16	55.2	11	37.9	27	93.1	2	6.9	29
Lead Pencil Factories	10	77.0	3	23.0	13	100.0	..	..	13
Linseed Oil Works	11	73.3	4	26.7	15	100.0	..	..	15
Machine Shops	140	60.4	78	33.6	218	94.0	14	6.0	232
Match Factories	38	73.1	10	19.2	48	92.3	4	7.7	52
Mattress Factories	151	75.5	45	22.5	196	98.0	4	2.0	200
Mercantile	459	79.0	106	18.2	565	97.2	17	2.8	582
Metal Reduction Works	3	75.0	1	25.0	4	100.0	..	..	4
Metal Workers	365	63.0	187	32.3	552	95.3	28	4.7	580
Miscellaneous	159	67.9	63	26.9	222	94.8	12	5.2	234
Morocco Leather Shops	6	33.3	9	50.0	15	83.3	3	16.7	18
Motion Picture Theatres	5	62.5	3	37.5	8	100.0	..	..	8
Musical Instrument Factories	71	67.6	30	28.6	101	96.2	4	3.8	105
Oil Clothing Factories	7	70.0	3	30.0	10	100.0	..	..	10
Oilcloth and Linoleum Works	20	29.9	32	47.7	52	77.6	15	22.4	67
Oil Refineries	3	42.8	4	57.2	7	100.0	..	..	7
Packing House and Slaughter	34	70.8	13	27.1	47	97.9	1	2.1	48
Paint and Color Works	98	73.1	32	23.9	130	97 0	4	3.0	134
Paper Box and Papeterie	65	71.4	25	27.5	90	98.9	1	1.1	91
Paper Mills	204	49.7	164	39.9	368	89.6	43	10.4	411
Patent Leather Works	5	41.6	5	41.6	10	83.2	2	16.8	12
Picture Frame Factories	24	60.0	12	30.0	36	90.0	4	10.0	40
Plumbers' Supplies	9	75.0	3	25.0	12	100.0	..	..	12
Potteries	31	62.0	17	34.0	48	96.0	2	4.0	50
Printing and Lithographing	275	79.7	57	16.5	332	96.2	13	3.8	345
Pulp, Miscellaneous	5	29.4	9	52.9	14	82.3	3	17.7	17
Pulp, Soda	1	20.0	1	20.0	2	40.0	3	60.0	5
Pulp, Sulphite	12	40.0	11	36.7	23	76.7	7	23.3	30

Table No. 9—Continued.

	Extinguished Fire.		Held Fire in Check.		Total Satisfactory.		Unsatisfactory.		Total No. of Fires.
	No.	%	No.	%	No.	%	No.	%	
Restaurants	7	100.0	..	..	7	100.0	..	..	7
Rice Mills	..	..	1	100.0	1	100.0	..	..	1
Rolling, Wire and Tube Works	13	46.4	14	50.0	27	96.4	1	3.6	28
Roofing Works	11	47.8	11	47.8	22	95.6	1	4.4	23
Rubber Cloth Factories	8	53.3	7	46.7	15	100.0	..	..	15
Rubber Reclaiming Works	3	37.5	4	50.0	7	87.5	1	12.5	8
Rubber Works	66	49.6	61	45.8	127	95.4	6	4.6	133
Saw and Planing Mills	55	41.6	43	32.5	98	74.1	34	25.9	132
Shirt Factories	27	79.4	7	20.6	34	100.0	..	..	34
Shoddy Mills	109	63.8	50	29.2	159	93.0	12	7.0	171
Silk Mills	26	65.0	11	27.5	37	92.5	3	7.5	40
Skin Mills	2	66.7	1	33.3	3	100.0	..	..	3
Soap Manufacturing	17	81.0	3	14.3	20	95.3	1	4.7	21
Stamping and Sheet Metal Works	22	53.7	14	34.2	36	87.9	5	12.1	41
Starch and Glucose Mills	8	50.0	3	18.7	11	68.7	5	31.3	16
Sticky Fly Paper Factories	3	75.0	1	25.0	4	100.0	..	..	4
Sugar Refineries	12	70.7	5	29.3	17	100.0	..	..	17
Tanneries	23	47.9	20	41.7	43	89.6	5	10.4	48
Tenant Manufacturing	303	72.2	98	23.3	401	95.5	19	4.5	420
Theatres	25	80.8	5	16.1	30	96.9	1	3.1	31
Tobacco Factories	34	66.7	15	29.4	49	96.1	2	3.9	51
Trunk Factories	6	66.7	3	33.3	9	100.0	..	..	9
Varnish Works	3	75.0	..	..	3	75.0	1	25.0	4
Wall Paper Factories	8	72.7	1	9.1	9	81.8	2	18.2	11
Warehouses	108	67.5	44	27.5	152	95.0	8	5.0	160
Waste and Batting Mills	158	69.3	62	27.2	220	96.5	8	3.5	228
Waste Paper and Rag Shops	21	72.4	8	27.6	29	100.0	..	..	29
Weaving Mills	67	59.8	42	37.5	109	97.3	3	2.7	112
Whip Factories	3	75.0	1	25.0	4	100.0	..	..	4
Window Shade Factories	7	87.5	..	..	7	87.5	1	12.5	8
Woodworkers, Class A*	90	52.0	59	34.0	149	86.0	24	14.0	173
Woodworkers, Class B*	80	47.6	71	42.2	151	89.8	17	10.2	168
Woodworkers, Class C*	82	59.4	48	34.8	130	94.2	8	5.8	138
Woodworkers, Class D*	60	56.6	32	30.2	92	86.8	14	13.2	106
Woodworkers, Class E*	64	62.1	32	31.1	96	93.2	7	6.8	103
Woodworkers, Class F*	21	63.7	9	27.2	30	90.9	3	9.1	33
Woodworkers, Miscellaneous	1	50.0	1	50.0	2	100.0	..	..	2
Woolen Mills	657	70.3	227	24.3	884	94.6	49	5.4	933
Wool Storehouses	18	75.0	5	20.8	23	95.8	1	4.2	24
Worsted Mills	27	45.0	22	36.7	49	81.7	11	18.3	60
Total Sprinkler Fires	10326	..	5105	..	15431	..	762	..	16193

***Note.**— The Woodworkers are classed as follows:

Class A. Planing Mills; interior woodwork, builders' supplies (including veneer works).

Class B. Box Factories. (Including cigar boxes.)

Class C. Miscellaneous Woodworkers. Steam power tenant woodworkers (also woodworkers where there is a lack of detailed information as to class).

Class D. Sash, Door and Blind Factories.

Class E. Hard Wood Turning. (Wheels, pipes, novelties, bobbins, spools, etc., last and wood heel factories.)

Class F. Pails and Woodenware. (Plates, wooden bowls, tubs, etc.)

Table No. 10.

Classification of Unsatisfactory Sprinkler Fires by Occupancies.

	Water shut off sprinklers.	Gen. defective equipment and unsprinklered portions.	Defective water supply or supplies.	Sprinkler system crippled due to freezing.	Slow operation of dry system or defective dry valve.	Slow or defective operation of high test heads.	Faulty building construction, concealed spaces, vertical openings.	Obstruction to distribution.	Hazard of occupancy too severe for average sprinkler equipment.	Explosion crippled sprinkler system.	Exposure or conflagration.	Miscellaneous.	Not classified.	Total.
Agricultural Implements.	2	..	..	..	..	..	..	..	1	..	..	..	..	3
Automobile and Bicycle..	1	..	..	..	..	..	..	1	..	..	1	..	..	3
Bakeries	..	1	..	..	..	..	..	..	..	..	..	1	..	2
Boot and Shoe Shops	4	2	2	..	..	1	..	..	..	2	5	..	1	17
Broom Factories	2	..	..	..	..	..	..	..	..	..	..	..	..	2
Candy Factories	..	..	..	..	..	..	1	..	..	..	..	..	..	1
Canning Works.....	..	..	..	..	..	..	..	..	..	..	1	..	..	1
Car Houses.....	1	1	1	..	1	..	..	1	..	..	..	..	..	5
Car Works.....	..	1	..	..	..	..	..	1	..	..	..	..	..	2
Carpet Mills.....	4	1	3	..	..	..	..	1	..	..	..	..	..	9
Carriage Factories	..	1	2	..	1	..	..	1	..	..	2	..	..	7
Celluloid (Pyroxylin) ...	..	..	1	1	1	..	1	..	7	3	1	..	..	15
Cement and Plaster Works	..	..	..	..	1	..	..	..	..	..	..	..	..	1
Cereal Mills.....	..	2	1	..	..	..	..	..	..	1	..	..	..	4
Chemical and White Lead.	1	..	..	..	..	..	..	..	..	1	..	..	..	2
Clothing Factories.....	2	..	1	..	..	..	1	1	..	..	..	..	..	5
Coffin Factories.....	..	..	..	1	..	..	..	..	..	..	..	..	..	1
Cooperage Plants	1	3	..	..	..	1	..	2	..	..	1	..	..	8
Cordage Works.....	2	3	1	..	..	..	..	2	..	..	..	..	1	9
Cork Factories.....	1	..	..	..	..	..	..	..	..	1	..	..	..	2
Cotton Mills.....	19	11	6	..	..	1	4	1	..	..	..	3	4	49
Cotton Warehouses	10	1	2	..	..	..	1	3	1	..	..	1	..	19
Cotton Seed Oil Mills	2	3	2	..	..	..	..	..	..	..	..	2	1	10
Cutlery and Hardware ...	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Department Stores.....	4	3	..	..	..	..	..	1	..	..	2	..	1	11
Drug Houses	..	..	..	..	..	..	..	..	..	..	3	1	..	4
Dyeing and Bleaching....	3	1	1	..	..	1	..	1	..	..	1	..	1	9
Electrical Appliances	1	..	1	..	..	..	..	..	..	..	..	..	1	3
Electric Light and Power Plants.....	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Elevators, Grain.....	..	3	3	..	1	..	1	1	1	1	2	..	1	14
Excelsior Factories	..	..	1	..	..	..	..	..	..	..	..	..	..	1
Fertilizer Plants.....	1	..	..	..	1	..	..	..	..	..	..	..	..	2
Flour and Grist Mills	..	1	..	..	..	..	1	..	..	2	2	..	..	6
Foundries.....	4	1	1	..	..	..	..	..	..	1	..	..	..	7
Furniture Factories.....	7	12	2	3	..	..	2	8	6	..	2	..	..	42
Garage	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Glass Works.....	1	1	..	..	..	..	..	..	..	..	..	..	2	4
Glue Factories.....	1	..	..	..	..	..	..	..	1	..	..	..	..	2
Hat, Fur	1	2	1	..	1	..	..	..	..	..	..	..	..	5
Jewelry Shops.....	2	1	..	1	..	..	..	..	..	..	..	..	..	4
Knitting, Cop Yarn.....	..	1	3	..	..	..	..	..	..	1	..	..	..	5
Knitting, Full Process ...	6	8	5	1	1	..	..	..	..	1	..	..	..	22
Laundries.....	1	..	..	..	..	..	..	1	..	..	..	..	..	2
Machine Shops.....	9	3	..	..	..	..	..	1	..	1	..	..	..	14
Match Factories	2	..	..	..	..	..	..	..	1	..	..	1	..	4
Mattress Factories.....	2	1	..	..	..	..	..	1	..	..	..	..	..	4
Mercantile	7	2	..	1	1	..	1	..	..	..	4	..	1	17
Metal Workers.....	11	9	2	..	..	..	..	..	..	1	2	1	2	28
Miscellaneous.....	2	3	1	..	1	..	2	..	1	..	3	1	..	14
Morocco Leather Shops ..	..	2	..	..	..	..	1	..	..	..	..	..	..	3

Table No. 10—Continued.

	Water shut off sprinklers.	Gen. defective equipment and unsprinklered portions.	Defective water supply or supplies.	Sprinkler system crippled due to freezing.	Slow operation of dry system or defective dry valve.	Slow or defective operation of high test heads.	Faulty building construction, concealed spaces, vertical openings.	Obstruction to distribution.	Hazard of occupancy too severe for average sprinkler equipment.	Explosion crippled sprinkler system.	Exposure or conflagration.	Miscellaneous.	Not classified.	Total.
Musical Instrument Factories	..	3	..	..	..	..	..	..	..	..	1	..	..	4
Oilcloth and Linoleum Works	..	3	..	..	..	..	1	..	11	..	..	..	..	15
Packing House and Slaughter	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Paint and Color Works	1	1	1	..	..	..	1	..	..	..	..	..	..	4
Paper Box and Papeterie	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Paper Mills	6	16	4	2	..	2	2	..	1	1	2	4	3	43
Patent Leather Works	1	..	..	..	..	..	1	..	..	..	..	..	..	2
Picture Frame Factories	1	2	..	..	..	..	..	1	..	..	..	..	..	4
Potteries	..	..	..	1	..	..	..	..	..	1	..	..	..	2
Printing and Lithographing	4	4	1	..	..	..	..	..	..	..	3	1	..	13
Pulp, Miscellaneous	1	1	1	..	..	..	..	..	..	..	..	..	..	3
Pulp, Soda	2	1	..	..	..	..	..	..	..	..	..	..	..	3
Pulp, Sulphite	3	1	..	..	1	1	..	..	..	..	..	..	1	7
Rolling, Wire and Tube Works	..	..	..	..	..	..	..	..	..	..	..	..	1	1
Roofing Works	..	..	..	..	..	..	..	..	..	1	..	..	..	1
Rubber Reclaiming Works	..	..	..	..	..	..	1	..	..	..	..	..	..	1
Rubber Works	2	..	..	1	..	..	..	..	2	1	..	..	..	6
Saw and Planing Mills	7	6	1	..	3	1	6	2	1	..	4	1	2	34
Shoddy Mills	4	1	5	..	..	2	..	..	..	..	..	..	..	12
Silk Mills	1	1	..	..	..	..	..	..	..	1	..	..	..	3
Soap Manufacturing	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Stamping and Sheet Metal Works	..	2	1	..	1	..	..	..	..	..	1	..	..	5
Starch and Glucose Mills	..	..	..	..	..	..	..	..	1	4	..	..	..	5
Tanneries	1	..	..	2	..	..	..	..	..	..	1	..	1	5
Tenant Manufacturing	5	3	2	..	1	..	1	1	..	..	5	..	1	19
Theatres	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Tobacco Factories	1	..	..	..	..	..	..	..	..	..	1	..	..	2
Varnish Works	..	..	..	..	..	..	..	..	1	..	..	..	..	1
Wall Paper Factories	..	..	1	..	..	..	..	..	..	..	1	..	..	2
Warehouses	5	2	..	..	1	..	..	..	..	..	..	..	..	8
Waste and Batting Mills	1	3	1	..	..	1	..	1	..	..	..	1	.	8
Weaving Mills	1	..	1	1	..	..	..	..	..	..	..	..	..	3
Window Shade Factories	..	..	..	..	..	..	..	..	1	..	..	..	..	1
Woodworkers, Class A*	5	8	..	..	..	..	..	5	..	2	3	1	..	24
Woodworkers, Class B*	3	5	2	..	..	..	1	1	..	2	2	1	..	17
Woodworkers, Class C*	2	3	1	..	..	..	..	2	..	..	..	..	..	8
Woodworkers, Class D*	1	5	..	1	..	..	..	..	..	1	3	3	..	14
Woodworkers, Class E*	3	1	..	..	1	..	2	..	..	..	..	..	..	7
Woodworkers, Class F*	2	..	..	..	..	..	..	1	..	..	..	..	..	3
Woolen Mills	8	14	10	1	..	2	3	..	..	..	3	4	4	49
Wool Storehouses	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Worsted Mills	2	2	2	1	..	..	..	..	..	..	..	2	2	11
Total Unsatisfactory Fires	193	177	77	18	18	13	35	42	37	30	62	29	31	762

*See detailed classification of woodworkers as given in note under Table No. 9.

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